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EDITORIAL.

Rubber.

The recent decision against compulsory rubber restriction has at least the advantage of having swept away some of the uncertainty which encompassed the industry. Estate financial policy, in most cases, depended upon the settlement, one way or the other, of the discussions of 1931 on the subject of restriction. Although the decision may have come as a disappointment to many, yet it is welcome by reason of the fact that estates can now frame their policy with a clearer perception of the serious problems that have to be faced.

To assist the industry as far as possible in these considerations we have attempted in this number to review Malayan rubber production, both statistically and from the point of view of estate management, in respect of the year 1931.

The subject matter emanates from the Rubber Research Institute of Malaya, the Department of Agriculture, S.S. and F.M.S., and the Department of Statistics, S.S. and F.M.S. The close liaison maintained between these three organisations has enabled this information for 1931 to be issued at this early date.

It is a truism that the present crisis of the rubber planting industry is the result of under-consumption rather than over-production.

Less than a decade ago a very able journalist, who resided in Malaya for many years and had made a study of the economics of the rubber position, publicly stated that by 1932 the demand for rubber would by far exceed the supply.

The author of this forecast did not visualise the present disorganisation of world trade, and it is possible that, but for the state of world finance, the normal expansion of rubber consumption would have kept pace with the increasing supplies.

However, the industry to-day finds itself in a position to produce ever-increasing quantities of rubber on a market glutted with stocks and in the face of a consumption that evinces little signs of recovery.

The fall in the price of rubber has necessitated the reduction of cost of production on estates. This has been achieved generally by drastic economies in labour and management expenses, the postponement of all but urgently necessary agricultural improvements, and the tapping of the highest yielding areas only. In addition, the industry has been maintained in no small measure

by relying on reserve funds and the investment of more capital in the hope of tiding over the present difficult period.

The trend of present policy in the endeavour to maintain the industry is to increase the productive capacity. This is seen in the curtailment of tapping of the less productive areas, and the increase of budgrafted rubber. Concurrently, efforts are being made, and have already produced significant results, in lowering factory costs by dealing more efficiently with crops harvested.

While wages are at an unduly low level, and field improvements reduced to a level which should not be considered as permanent, there is little doubt that the cost of production of rubber will in the future be on a lower level than hitherto.

The present policy appears to aim at meeting over-production and under-consumption by more intensive production on areas actually in tapping and in the attainment of this object scientific research is closely allied with producers.

Critics of the present policy deplore the efforts of the scientist to increase production in the face of steadily accumulating stocks. We cannot concur in the contention that scientists are thus aggravating a serious position and that they are therefore not serving the best interests of the industry that supports them.

The aim of science in all commercial fields has undoubtedly been to contribute to the cheapening of the means of production by increased output, but this object is an aid to industry and of benefit to the community at large, and is not the cause of our present troubles.

The justification of the aims of science has been ably defended by Dr. Seligman in a recent speech at Newcastle. He pointed out that the fault lies not with the results of scientific production but with our legislators, our manufacturers, our economists and our workers who are not accustomed to the exercise of the powers thus placed in their hands. Modification of old ideas are necessary to meet the new standards which will result in better conditions for the individual.

The policy should not be to deny the use of science, but to encourage science to further achievement and for the world to harness the results with common sense, caution and responsibility.

To return to our present difficulties in the rubber industry, the need is not for fewer scientists, but for their encouragement, in showing the way to more efficient production and in devising new applications which will not only result in the consumption of excess stocks and future deliveries, but be of ultimate benefit to mankind.

The rôle of science in the rubber industry has been a most creditable one. In a comparatively restricted area there now exists about ten-thousand million rubber trees. With the aid of science, this population has been made to improve in yield and in quality.

The signal services of science to the industry in the past does not indicate that nothing more may be expected from research, but rather that science may

still prove a source of inspiration to further improvements in production and to a wider application of the use of perhaps the cheapest product with the widest range of possible applications that there is in the world to-day.

Finally, we would draw attention to the improvements in production which have been made during the past year, a brief account of which is given in the following pages. These improvements touch on the subject of production from almost every angle.

Not least of the services to the industry is that of the statistical information which of recent years has been vastly improved and more systematically presented. In this service, as indeed for all work connected with the industry, the close contact of the various branches of science is essential, but equally important is the close contact of scientists with both producers and consumers. Research must understand the needs and difficulties encountered by all branches of the industry. We are fortunate that in this country investigators and producers give mutual support, while a similar liaison is daily becoming stronger between scientific workers and consumers.

THE PREPARATION OF RAW RUBBER.

Recent Advances in Estate Factory Methods.

BY

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For many years there has been little revolutionary change in rubber estate factory methods for the preparation of raw rubber.

The phenomenally high market prices of raw rubber have militated against such changes since there has, until recently, been no great incentive for improvement of machinery and equipment for the preparation of the two principal grades of "first latex" rubber—smoked sheet and thin pale crepe.

The principal improvements have been the general installation of large coagulating tanks and the increased application of aluminium for such tanks and other equipment in place of the old cement tanks lined with glazed tiles or wooden tanks with wood partitions. On large estates the use of coagulating pans is practically obsolete.

These innovations have resulted in the bulking of larger quantities of latex, thus improving the uniformity of the raw product.

In view, however, of manufacturers' complaints of lack of uniformity not only in rubber from different estates, but also in rubber prepared at different times on the same estate, which is confirmed by our own investigations, it is obvious that there is still room for further improvement in this direction, which can only be effected by further bulking of large quantities of latex and greater attention to uniformity of preparation starting with the dilution of the latex and the subsequent machining, drying and smoking under more standard conditions.

Smoked Sheet *versus* Thin Pale Crepe.

Owing to the fact that the premium on thin pale crepe has until recently been insufficient to render the preparation of this grade economical in relation to smoked sheet, several estates have abandoned its manufacture.

At the present time, owing to this fact that a number of estates have ceased to prepare thin pale crepe, the tendency is to create a much larger margin in the market price in favour of such crepe. Its preparation may therefore again increase on estates equipped with heavy crepeing machinery.

In view of the present and prospective future prices, it is extremely doubtful, however, whether any new estates will adopt the preparation of this grade especially since investigations at the Rubber Research Institute indicate the probability of the substitution of a thin pale sheet which can be used in its place.

This will be discussed later under the section dealing with air-dried sheet.

Factory Machinery for Sheet Manufacture.

The greatest and most revolutionary advance which has taken place recently,

as a result of investigations carried out at the Rubber Research Institute, has been the construction and installation of batteries of light sheeting machines in cascade or file formation instead of in line, in order to facilitate and accelerate the handling and machining of the coagulum.

As a result of investigations on a large number of estates, it was ascertained that the best outputs on the average estate light sheeting batteries in operation were about 500 lbs. of dry rubber per hour on a battery of three smooth and one marking machine.

By increasing the depth of coagulating tanks, and installing 24 inch roll machines in file formation, outputs of 2,500—3,000 lbs. of dry sheet per hour are now attained. Careful attention, however, has to be paid to the correct synchronisation of the machines, so that there is no accumulation of coagulum between each machine and that no machine is running "idle".

Sheets of 18 inch width when dry can be prepared, which fit the normal wooden packing cases.

By nipping together the ends of each strip of coagulum from the coagulating tanks or by cutting the alternate ends of each aluminium partition in the coagulating tanks, a continuous coagulum can be machined.

This necessitates a plentiful supply of water to maintain the coagulating tanks full, during machining, so that the coagulum floats and can be easily handled. Aluminium chutes to convey the coagulum to the first machine and between the successive machines are also essential to reduce handling and to accelerate the operations.

Such a battery can be operated by three labourers. A battery consisting of at least five and preferably six machines is recommended, in order to prepare a satisfactory and uniform product.

A more recent battery constructed by a local engineering firm consists of one three-roll machine, two two-roll machines and a two-roll marking machine driven by a 5 H.P. prime mover. Although this battery has not yet been tested under the most efficient conditions, it appears capable of an output of 2,500—3,000 lbs. of dry sheet rubber per hour. Such batteries are sufficient to treat the crop from an area of 6,000 acres.

It is realized that many estates are unable for financial reasons to re-organise their present factories by scrapping their present machinery and installing these new batteries, and also that smaller areas may not gain much advantage by so doing. It has, however, been demonstrated on a number of smaller estates that considerable increase of output and saving of factory labour can be effected by minor alterations at a small cost. On a number of estates, savings considerably in excess of the cess paid to the Institute have been effected as a result of recommendations made and adopted.

Drying and Smoking of Sheet Rubber.

Considerable attention has also been devoted to improvements in the drying and smoking of sheet rubber.

It has been shown that a large portion of the moisture in sheet rubber can be removed by air-drying for 5 to 6 hours at normal temperature in a shaded but well ventilated site, before the sheets are placed in the smoke house. This enables the sheet to be smoked in 4 to 5 days, or less than half of the normal period previously practised and results in considerable economy of wood fuel.

The necessity for better ventilation of both smoke houses and fire boxes and the better distribution of heat has also been demonstrated.

It has also been shown that most outbreaks of fire in smoke houses are due to the accumulation of inflammable gases due to insufficient ventilation of the fire boxes resulting in the dry distillation of the wood fuel which produces such gases. The lack of ventilation in the smoke house itself causes these gases to accumulate and a spark may ignite them causing an explosion and subsequent fire.

Air-dried Sheet.

Investigations have indicated that air-dried sheet, provided it is dried at not too high a temperature, is a satisfactory substitute for smoked sheet and enables the raw product to be dried under more controlled conditions by the use of hot water or steam pipes.

One large company is already preparing its rubber in this manner and several consignments of such sheet have been shipped by other estates.

Another aspect of this problem is the substitution of a pale air-dried sheet for thin pale crepe.

In order to obtain the pale colour it will be necessary to add sodium bisulphite to the latex, since such pale rubber is used in the manufacture of pale transparent dipped goods.

In view of the fact that thin pale crepe contains a minimum amount of non-caoutchouc serum products, due to its washing and machining, it will be essential to remove such products from sheet by prolonged soaking in running water. Such products when left in the raw rubber produce a cloudy appearance which is not desirable in the finished dipped goods. They also render the rubber less uniform in vulcanisation and tend to increase mould development ("Spot" disease). The preparation of a thin pale sheet even at the rate of 1,000—1,500 lbs. per hour on light sheeting machinery will be a great advance on the output of the present heavy crepeing machines and will eliminate all heavy machinery except for central factories in districts for the treatment of the 10—15 per cent. of lower grades (tree scrap, lump, etc.).

Any estate, with a suitable drying room, as well as a smoke house, could prepare either smoked or ordinary air-dried sheet or the thin pale air-dried sheet according to market requirements and price.

Sole Crepe.

The demand for sole crepe appears to have become more than stabilised resulting in low prices for this product, which are scarcely economic. This is due partly to an increase in the number of estates now preparing this product

and the fact that manufacturers of vulcanised rubber soles have improved and cheapened their products to compete with sole crepe prepared on estates.

New Types of Raw Rubber.

Investigations on types of raw rubber more suited to manufacturers' requirements are being initiated and also special types of raw rubber which are required for specific purposes. These embrace particularly rubber used for the manufacture of ebonite (vulcanite) for insulation purposes, which probably requires a minimum of hygroscopic serum products in the finished product and also more plastic raw rubber which may replace reclaim or may be more economical to mill.

At present the situation appears to be somewhat chaotic judging from opinions expressed by various manufacturers or their technical advisers.

It is hoped to clarify these views, which may be due to different methods of manufacture and articles manufactured, by more detailed and personal enquiries with the leading manufacturers.

The manufacture of different types of raw rubber on estates will also almost certainly require alterations in present methods of marketing, since the buyer is not in a position to determine the intrinsic properties of raw rubber which are of importance to the manufacturer.

In this connection a few remarks *apropos* recent statements in the technical literature on the subject of the futility of the preparation of "pretty" rubber are desirable.

While the chemist working on behalf of the producer is compelled to devote his attention to defects in raw rubber which affect its selling price when purchased by the usual buyer who is not a manufacturer, it is realised that many of these so-called defects are of no importance to the manufacturer. The importance of cleanliness and freedom from fine sand or other débris is, however, of great importance, and satisfactory methods have been recommended for eliminating foreign matter of this kind.

At the same time, it may be emphasized that sheet rubber of uniform appearance and regular thickness does not necessarily cost more to prepare than sheet of irregular appearance with thick corners and edges. In fact, the latter may cost more, by requiring a longer period of drying resulting in extra cost of fuel, while it may result also in considerable cutting out of the undried portions resulting in a loss of price.

In the case of thin pale crepe required especially for the manufacture of thin pale dipped goods, colour and evenness of appearance are essential.

Finally, it may be stated that a raw rubber of good appearance and even thickness indicates care in preparation and uniform methods of preparation which are more likely to result in uniform properties.

Packing of Rubber.

It has been shown that considerable economies in packing can be effected by the use of treated hessian in place of the usual wooden chests. Enquiries have been addressed to the Rubber Growers' Association in relation to this problem. Such packing is already adopted by several large buyers.

Latex and Concentrated Latex.

Considerable increase in the export of latex is taking place which indicates increasing application of latex for present or new uses.

Difficulties in connection with the sampling and determination of dry rubber content of such latex have occurred and are being investigated. The ammonia solution used as a preservative also appears to be irregular in strength and results in bad consignments being prepared. Several estates have adopted with satisfactory results, our recommendations to use the compressed anhydrous ammonia gas imported in steel cylinders, especially owing to the danger in opening and handling the strong ammonia solution (Liquor Ammon Fortis) which at tropical temperatures is under considerable pressure in the drums in which it is contained.

There also appears to be a considerable demand for latex containing 4 lbs. of dry rubber per gallon, a concentration which is not easy to obtain on all estates. Revertex (latex concentrated by evaporation in the presence of a protective colloid) is still manufactured on one estate, but its production has ceased on the estate on which its preparation was originated. Considerable quantities of latex concentrated by the Utermark process in centrifuges are exported by the Dunlop Rubber Plantations Ltd.

Investigations on creaming process for concentration and also on alternative methods of preservation are in progress at the Institute. The Rubber Growers' Association and manufacturers are interested in this problem and have invoked the collaboration of the Institute.

Non-caoutchouc Constituents of Latex.

Progress has been made in the investigation of the non-caoutchouc constituents of latex which, although present in small quantities, have a profound influence on the properties of the prepared rubber.

Considerable quantities of quebrachitol (1—methyl inosite) have been prepared in a pure state from the serum of latex and distributed among various chemical manufacturers with a view to its possible utilisation. An interesting substance—Lipin—has also been isolated and found to confer peculiar properties on the raw rubber. Its similarity to lecithin derived from eggs and soya bean has been indicated. While the amount present may be too small for extraction for commercial application, the investigation of this and related products may prove to be of value in relation to rubber and other industries.

Rubber Roadways and New Uses

The utilisation of latex in conjunction with road-making products, such as asphalt or bitumen and their emulsions and other cheap fillers, is under investigation at the Institute with a view to the possibility of preparation of suitable products in a paste form which can be spread as a road-surfacing material.

The difficulties of converting laboratory results into large scale practical operations have been demonstrated and have still to be overcome. It is too early to make any statement as to the probable success of such investigations.

Investigations into the application of latex as a paint vehicle also show promising results, but the practical application of such products will depend on their utility compared with products already in use.

It may be emphasized that considerable progress is being made by rubber and other manufacturers in the direct use of latex for new uses, particularly for the manufacture of sponge rubber for upholstery, cushions, etc. and in other directions.

These investigations, and more especially the adoption of the products, must necessarily be slow.

BUDDING OF RUBBER TREES.

The Position in 1931

BY

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During 1931 although relatively small areas were newly planted with rubber, the enquiries dealt with by the Botanical Division of the Rubber Research Institute indicate that the interest in budding problems was fully maintained.

Apart from numerous enquiries covering varied details of the general technique of budding and the after-care of budded plants the subject most frequent dealt with was the choice of clones for immediate planting or multiplication for the future. There was also an increased interest in the budding of stocks older than the usually recommended year or eighteen months.

The clones recommended for planting included the oldest clones in Malaya, Java and Sumatra, of which the published yields are shown in the table.

Yields of Various Clones.

The yield of clone Bodjong Datar 5 increased from the 12th to 13th year after establishment, and this clone can be regarded as very satisfactory. Growth in the first year after budding may be rather slow, but the plants look very vigorous and grow more rapidly in the second year.

The yield of clone Bodjong Datar 10 has remained almost constant. This clone has received some criticism because the trunk is rather flattened and not circular in section, but it is considered that this character is not sufficiently pronounced to interfere with tapping.

Clone Tjirandji 1 has been the subject of many adverse rumours. In the beginning of 1929 a windstorm destroyed three out of five trees. The mean yield of the two trees left was about the same as the mean of all. In 1930 these two trees gave 31.6 pounds per tree per 160 tappings. This yield is so high that (assuming an average variation) there is a very big chance that it is really a good clone and worthy of inclusion in planting programmes. It has been used extensively by Tjirandji and sister estates and young trees were brought into tapping during the year. The yields of clone Tjirandji 16 dropped slightly.

Unfortunately, owing to shortage of staff and so on, the AVROS Proefstation did not publish the 1930 yields of their clones, and recommendations had to be based on previous records. For 1931 planting, however, the Proefstation recommended the same clones as before,—49, 50, 152, 256 with the younger clones 185 and 214.

Monthly records of the prominent Malayan clones were received and a number of visits of inspection were paid by the Botanical Division of the Institute. Several clones reached the age of ten years and completed four years' records of tapping, and can now be recommended with some confidence for planting pure blocks of single clones.

TABLE SHOWING YIELDS OF NETHERLANDS EAST INDIES AND MALAYAN CLONES

2nd JUNE, 1931.

Clone.	Where planted.	Date of Establishment.	No. of trees in test	Tapping Cut.	Yield in lbs. dry rubber per tree per 160 tappings for calendar year nearest to—								
					4 to 5 yrs	5 to 6 yrs	6 to 7 yrs	7 to 8 yrs	8 to 9 yrs	9 to 10 yrs	10 to 11 yrs	11 to 12 yrs	12 to 13 yrs.
JAVA.													
B.D. 5	Bodjong Datar	Feb. 1918	8	1/3						20.8	25.0	24.3	27.0
B.D. 10	- do -	- do -	48	1/3						18.5	18.7	18.7	18.9
Tj. 1	Tjirandji Estate	1920	2	1/4					27.5	23.9	31.6		
Tj. 16	- do -	1920	11	1/3					21.3	21.8	18.0		
SUMATRA.													
AVROS 49	Seed Garden, Polonia	Jul. 1919	4	1/3	3.6	7.6	11.5	12.7	12.2	15.3			
AVROS 50	Seed Garden, Belawan	Jan. 1919	9	1/3	2.5	5.2	10.7	12.0	10.4	11.0	14.0		
AVROS 152	Boekit Maradja	Oct. 1922	100	1/3									
AVROS 185	Soengi Pantjoer	1922	4	1/3		7.8	12.6	14.0					
AVROS 214	- do -	Jan. 1924	10		5.5	9.4							
AVROS 256	Tamiang Estate	Oct. 1920	20	1/2				14.8	16.3	14.7			
MALAYA.													
S.R. 9	Kajang	Oct. 1921	88	1/2			10.7	16.4	17.2	17.9			
P.B. 186	- do -	Apr. 1922	261	1/2			11.9	16.0	20.5	27.9			
P.B. 23	- do -	- do -	63	1/2			13.7	16.2	17.8	20.7			
P.B. 180	- do -	- do -	211	1/2			12.2	13.5	14.5	23.2			
P.B. 86	- do -	Oct. 1923	250	1/2	10.6	12.5	15.0	18.4					
P.B. 123	- do -	June 1923	172	1/2		10.7	15.9	16.2	17.3				
P.B. 183	- do -	- do -	120	1/2		8.8	13.6	15.4	20.5				
G. 1	Glenshiel Estate	Dec. 1921	20	1/2			10.7	11.2	22.7				
R. 393	Rubana Estate	- do -	8	1/2			14.9	15.0	23.3	24.2			
S. 24	Sabrang Estate	Oct. 1921	18	1/2			12.6	20.6	19.8	22.6			

The yield of clone Sungei Reko 9 increased only slightly. Clone Prang Besar 186 continued its rapid increase in yield and gave the very satisfactory yield of 27.9 pounds in 160 tappings. These Prang Besar clones scattered together through the same area illustrate very well the difficulty of selecting clones at an early age. At 6—7 years, clones 186, 180 and 23 gave 11.9, 12.2 and 13.7 pounds, but when they were 9—10 years the order was reversed and their yields were 27.9, 23.2 and 20.7 pounds respectively. Clone 186 has steadily increased in yield, while clone 180 increased very little for two years and then made a sudden jump.

The yields of the other promising older Malayan clones Glenshiel 1, Rubana 393 and Sabrang 24 all increased slightly.

A few of the AVROS clones have now been test tapped in Malaya, but until records are available for all clones grown side by side, or grown in different places with the same standard clone, estates are still advised to make use of at least six or eight different clones, including the best from Malaya and from Netherlands India. Opinions have varied, however, as to the best policy to adopt in the use of a number of clones—whether to mix several clones in one area or to plant each clone in a separate block.

Systems of Planting Budded Rubber.

In August Mann([5])published an article setting out in greater detail than before the pros and cons of three methods :—I. Block or Monoclone planting, II. Mixed planting of a number of clones, III. Mixed planted of one old with one younger clone, with the eventual object of cutting out one and leaving a pure block. The balance of argument is largely in favour of I or III though some planters still adhere to II, and the Proefstations of Java and Sumatra still appear to incline to mixed planting though they admit that large areas have been planted in pure blocks.

The main points in favour of monoclone planting are ease of budding supervision and consequent economy, the even character of the stand with resultant uniformity of tapping, and the ability to tap each clone on the system most suited to it. If the clone for any reason proves a failure—falling off in yield, development of poor renewed bark or liability to disease—then the clone is cut out as a whole and complete replanting of the block can be carried out more satisfactorily.

Clones with a long tapping history, which includes a period of tapping on renewed bark, are suitable for monoclone planting, but in practice clones that have given high yields up to about 10 years of age have been planted in blocks. In the clones that have been tapped on renewed bark there has been no reduction in yield, and it is practically certain that a clone with even and thick renewal will be safe. Younger clones are planted mixed, and still younger ones have been recommended for multiplication—longer records will be available by the time the budwood is ready for use.

In addition to the clones mentioned, the records of the Waringiana clones

in Java and Lampongiana clones in South Sumatra were published during the year, but though several of these have given very good yields they are scarcely available to the planter in Malaya owing to the imposition of a fee of 1,000 guilders for planting rights in addition to the cost of the budwood.

New Clones.

The search for new clones is being continued, and a number of estates have areas of their own buddings in tapping. Some of these are very promising—e.g. Pilmoor clone D. 65 gave 15.9 pounds in its 6th to 7th year, which is equal to the previous best record of a clone of its age. The Rubber Research Institute has established a clone trial area with buddings from 149 estate mother trees all of which had given a yield of at least five times the mean yield ([4 & 6]) of the task in which they stand. New clones have also been established from over 700 seedlings obtained by hand pollination of the Pilmoor clones. Thus it is highly probably that it in a few years we shall be planting still better clones with yields nearer to 30 than 20 pounds per tree at an age of ten years.

At present there is a choice of more than ten clones giving 20 pounds or more per tree per year at ten years old and so with this material, yields of 1,500 pounds per acre are certain and yields of 2,000 pounds quite in the realm of practical possibility.

Selection of Clones Suitable to Special Conditions.

There has been a tendency to ask for recommendations of special clones suited to special environments. So far such information is not available as there are very few areas of buddings in tapping away from their estate of origin. A start has, however, been made by the Rubber Research Institute in the collection of growth records of the well-known clones from estates with varied conditions of soil and climate. Analysis of these figures may enable us to say that a certain clone grows well in laterite soils but not in peat, or other type of soil, though generalisations may be difficult owing to the part played by the vigour of the stock in influencing the vigour of the budding.

Susceptibility to Damage and Disease.

During the year there has been shown some interest in the liability of certain clones to damage and disease. One of the reasons for the dropping of clone AVROS 80 from the planting programme was its liability to pink disease, and several Managers have shown an inclination to make use of their supplies of this clone in districts where pink disease is unknown. If the yield of this clone was still equal to other AVROS clones this would probably be a sound view and with block planting the control of such a disease would be relatively easy.

On two or three estates the attacks of grasshoppers have been confined to clone AVROS 152. In one hilly area in Pahang, planted with a mixture of about ten clones, this was very striking towards the tops of the hills and on the

sunny slopes. Walking through a heavy cover as many as twenty grasshoppers were often in the air at the same time, they rested on the leaves and stems of AVROS 152 rather than on other clones; and most plants of this clone had their leaves eaten, and some were completely defoliated. In the worst areas, unbudded seedlings and other clones were just showing signs of attack several weeks after the first observation of damage to clone AVROS 152. In areas where grasshoppers are abundant, this selective feeding may be serious and sufficient to bar the planting of their favourate clone, but many and large areas of this clone have grown successfully without damage so it is probable that the trouble is strictly local and not sufficient to justify a general recommendation not to plant this clone.

Another type of trouble is the liability of certain clones to wind damage. This is well known in clone AVROS 36, which suffered severely in Sumatra and was dropped from the list of recommended clones. It is interesting to note, however, that this trouble has not been reported in Java. This year, especially with buddings on big stocks, there has been trouble with the breaking of bud shoots a few months old at or near the union, or at a height of several feet on rather older plants. This has occurred largely in exposed situations during wind storms. There has been a suggestion that clone Sungei Reko 9 is rather liable to such breakage, but at present we have not collected sufficient evidence to assess this liability. This clone is a very vigorous grower and it is probable that breakage is connected with a tendency to softness of wood, though the mature trees have not suffered. It is likely that with closer planting sufficient plants would escape damage to leave a good final stand.

Technique of Budding.

As the evidence in favour of budding has accumulated, many companies have made late decisions to bud, and consequently a good deal of attention has been given to the technique of budding seedlings 3, 4 and 5 years old. On the whole, budding-coolies have adapted themselves to the necessary modifications in technique and have obtained very good success. The main difficulties with budding on older stock lie in the after-care—treatment of the snags and pruning. Instructions for the treatment of pruned surfaces were published by Sharples and Mann. ([7]) The chief points are immediate treatment of the cut surface with a disinfectant followed by an application of an asphalt-kerosene mixture on the next day to prevent the entrance of die-back fungi, which might kill the stock to below the level of the bud. When the bud shoot is well established and showing brown wood at the base and there is a definite ridge between the growing stock and the dead snag, the snag is cut back just to the rim of live tissue and the new cut treated as before. After this, callus formation over the cut surface should start fairly rapidly.

If the bark of large stocks will not strip near the ground, budding can be carried out higher up. The cylindrical trunks of buddings give room for a long panel and the yields from high cuts are but little less than from low ones. Ever

if the tapping cut comes down on to the stock, better yields can be expected than from unbudded seedlings. When this recommendation of the possibility of high budding was first made by Mann there was available evidence from a small experiment by Dr. Cramer in Java and from a large scale experiment in Sumatra, which showed that the yields from seedling stocks budded high with scions of good clones were definitely higher than the yields of unbudded seedlings of comparable origin. In the last few months other papers have been published ([1 & 2]) relating to several experiments in Java which confirm the results of the earlier experiments.

Uniformity.

Uniformity of habit and performance has generally been regarded as an important attribute of the trees of a single clone and the variability of buddings within a single clone has received attention. The coefficient of variability of yield is of the order of 25 per cent. of the mean, so that there is a considerable difference between the yields of the best and of the worst trees in a clone. The best may be 75 per cent. greater and the worst 75 per cent. less than the mean. Thus, although the variability is considerably less than for seedlings, a clone is still far from uniform. It was found for the Pilmoor clones that there is a very close correlation between girth and yield within a clone([4]). This has been confirmed by Van der Hoop in Java([3]) for clones on Wangoenredja Estate, though Wenniger([8]) states that in a clone Djasinga 1 there is no such correlation. However, for the Pilmoor clones the correlation is so close that in one clone a rogue tree was discovered from its unusual position in the correlation table, and Van der Hoop also found that one of his clones was mixed from a forked scatter of the points in the table. Both of these observations were subsequently confirmed by a study of seed and leaf characters.

Thus, with close planting in a block of one clone, the smallest trees can be removed with the certainty that they are the poorest yielders, and the resulting stand will be more uniform.

The vigour of the stock greatly influences the vigour of a budding and greater uniformity can be obtained by more careful selection of only the best stocks for budding. Small plants can be budded successfully, but it is false economy to 'squeeze' a nursery as this will result in a large proportion of weakly buddings and fewer trees will be ready for tapping at an early age. For budding in the field, several seedlings should be planted to each hole and the most vigorous budded.

At present the records of many clones are based on only a few trees, but there are enough clones with one or two hundred trees in tapping as well as mixed areas of older clones in Sumatra to justify the conviction that the yields from areas of buddings will equal those from the original trees of the same clones, especially if due care is taken to achieve ultimate uniformity in a complete stand.

References.

1. Bobilioff, W. Enkele gegevens over Hooggeplaatste Oculaties.
   De Bergcultures, 24th Oct. 1931, p. 1200.
2. Van der Hoop, D. J. N. Eenige Resultaten van het tappen op Hooggezette Oculaties en hun Onderstam.
   De Bergcultures, 17th Oct. 1931, p. 1157.
3. Van der Hoop, D. J. N. The correlation between girth and yield in Seedlings and Buddings.
   Archief v.d. Rubbercultuur, August 1931, p. 336.
4. Mann, C. E. T. Annual Report of Rubber Research Institute—Plant Physiologist for 1930.
5. Mann, C. E. T. Further observations on Planting Systems for Buddings of Tested Clones.
   Journal of the Rubber Research Institute, Vol. 3, No. 1, p. 48.
6. Morris, L. E. Annual Report Rubber Research Institute Botanical Division for 1931.
7. Sharples, A. and Mann, C. E. T. Standard Instructions for the Protection of Pruned Surfaces in Budding operations.
   Journal of the Rubber Research Institute, Vol. 3, No. 1, p. 35.
8. Wenniger, W. F. M. de Buy. Variability of individual production of Hevea clones and their optimum planting distance.
   Archief v.d. Rubbercultuur. Oct. 1931, p. 619.

MANURING OF RUBBER TREES.

Review of Progress in 1931

BY

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The course of events in recent years has led to a very distinct cleavage between the scientific and economic sides of the question of manuring rubber. While it remains just as important as ever to gain knowledge based upon adequate field evidence, the question of monetary return has undergone a complete change of aspect. The relative position between the price of fertilisers and the price of rubber has changed so adversely that the increase in yield of rubber required to balance the cost of a fertiliser treatment is now several times as great as it was two or three years ago. However much this consideration may limit the possible application of the method it should not be allowed to interfere with the continued conduct of experiments already laid down. The cost of these must be regarded, not as an investment for monetary return, but as the purchase price of definite knowledge on an important subject.

The year 1931 has been marked chiefly by the publication of summaries of results of manuring experiments both in Malaya and in Java*. In October J. S. Vollema published complete details of over forty experiments conducted in West Java. These experiments date back to 1926 and cover a wide range of fertilisers, namely,

Sulphate of ammonia 32	Ephosphosphate 1
Chilean Nitrate 8	Sulphate of potash 12
Urea 6	Chloride of potash 8
Calcium cyanamide 7	Lime 8
Seed cake 1	Bonemeal 1
Double superphosphate 20	Diammonphos 5
Basic slag 1	Ammophos 20/20 2
Leunaphos 5	Fish guano 2
Nitrophoska 4	Potash-magnesium sulphate 1

Some of the experiments concerned growth measurements in nurseries and young rubber, but most of them were conducted as yield tests on mature rubber. Taken as a whole, the results were fairly consistent in giving small increases, but these were not of high statistical significance. Very few gave marked increases even after a number of years. The numerical data are given in the paper in some detail, including analysis figures for many of the soils. The author summarises the results as follows :—

* *Archief voor de Rubbercultuur*, 15 No. 10; the paper being No. 69 in the series Mededeelingen van het Proefstation voor Rubber.

Seedlings. Nitrogen and phosphate gave about 5 per cent. increase in height separately, and between 5 and 10 per cent. together. Potash alone gave no effect in the three cases tested. From 10 to 20 g. (20 g. = $\frac{3}{4}$ oz.) per plant was a suitable amount of fertiliser.

Young or poorly developed trees; height measurements.

	Positive Result.			
Fertiliser.	*Number of Expts.*	*Increase (height) over control.*	*Dubious.*	*No Effect.*
Nitrogen	2	6—10 per cent.	(1) (negative)	7
Phosphate	1	About 10 per cent.	—	5
Potash	4	5—30 per cent.	—	1
Lime	—	—	—	1
Nitrogen & phosphate	4	5—20 per cent.	—	—
Nitrogen + phosphate + lime	1	About 25 per cent.	—	—

Mature rubber, yields.

	Positive Result.			
Fertiliser.	*Number of Expts.*	*Increase over Control.*	*Dubious Number of*	*No Effect Expts.*
Nitrogen	11	5—25 per cent.	5	9
Phosphate	2	5—10 per cent.	2	10
Potash	1	About 5 per cent.	—	9
Lime	1	About 5 per cent.	1	3
Magnesium	—		—	1
N + P	1		—	1
N + P + K	1		3	—
N + P + K + lime	—		1	1

Nitrogen gave the best results but only four experiments (on laterite soil) gave yield increases of really effective amount (15-25 per cent.)

Two lbs. of sulphate of ammonia per tree given every year showed no advantage over 4 lb. given in alternate years. It was found most advantageous to apply the fertilisers in the wet season and not in the dry. Here it should be remarked that Java has a much more pronounced and prolonged dry season than Malaya. The wintering of the trees is not followed quickly by rains, as it is in Malaya.

The author makes some interesting comments on the question of the soil analyses. In the height measurements on young rubber the average nitrogen content of the soil was lower for those cases where nitrogen was effective, but it was not possible to set a limiting figure on which to base recommendations. Phosphoric acid values of the soil were not connected with the effect of phosphates on the plants. As regards yields there was no connection at all between

the soil analysis figures (including both total and available phosphates) and the effects produced by fertilisers. This statement should help to dispel the belief, still prevalent in planting circles, that a laboratory analysis of soil should form an adequate basis for recommendations on manuring of rubber.

The final conclusions reached from the experiments were that manuring of nurseries was very serviceable, especially on poorer sites. Young rubber could also be brought into earlier bearing in an effective manner, which would offer profitable return for superior (budded) material on poor soil. Manuring of old rubber was not economic even in the best cases, and the only ultimate prospect for these areas was considered to be replanting with budded material.

The paper covering the Malayan data was published in the same month as the Java paper*. The authors do not attempt to give details of all the experiments examined, but take typical cases for discussion to bring out the differences encountered. The general conclusions support the Java conclusions, though the authors are more inclined to suspend such definite judgment in view of the shorter time which most of the experiments had run. Also a few exceptional cases occurred where the improvement in yield was much higher than in any of the Java experiments. The paper emphasises all through the paramount importance of the nitrogen question. However doubtful may be the economic benefits from the addition of nitrogen at the present stage, there can be no doubt that the deficiency in this regard in the past is the cause of most of the troubles (deterioration) experienced. The view is put forward that more rational methods of soil management may in the future maintain natural nitrogen supplies at a sufficient level.

Another summary of Malayan results was published in the Annual Report of the Rubber Research Institute for 1930. Out of 100 cases of manuring which were reported in answer to a questionnaire, 13 showed "considerable yield increase" and 20 showed a small yield increase, while 26 showed vegetative response only and 17 no response at all.

Experience has shown the particular importance of proper nutrition of plants during their earlier stages. It is often impossible to make good afterwards the injury that may have been done. It is therefore important to include considerations of manuring in any programme for replanting old areas.

An experiment known as Block 6 at the Rubber Research Institute Experiment Station is worthy of note because its layout is sufficient elaborate to meet the demands of modern statistical analysis. The design is a Latin square of 36 plots of one acre each. During 1931 the published reports on this block reached the fourth series of measurements. The soil is virgin and the trees as yet less than three years old. The results from all manures have been very small, the largest being from the use of dung. The experiment has shown the unusually small standard error of 1.6 per cent., but this is not so surprising when it is remembered that the figure for each plot is the mean of some 80 measurements of distinct units.

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*W. B. Haines and C. F. Flint, R.R.I. Journal, Vol. 3, No. 2.

DISEASES OF RUBBER

BY

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The four most important diseases of rubber in Malaya at the present date may be listed as follows.

(*a*) Wet-Root Rot, caused by *Ganoderma pseudoferreum* (Wakef) Van O. et S.

(*b*) Root disease caused by *Fomes lignosus*. Klotosch.

(*c*) Mouldy Rot of the tapping panel caused by *Sphaeronema fimbriatum* (E. et H.) Sacc.

(*d*) Leaf disease caused by *Oidium Heveae*. n.s.

Investigations into (*a*), (*b*) and (*c*) have been pursued vigorously during 1931 and much progress can be reported in all three lines of work. The investigation projected under (*d*) did not materialise partly owing to the failure of the development of an *Oidium* attack and partly to the fact that the officer in charge of this work had to depart on leave to England on medical grounds.

Root disease (Wet-Root Rot) caused by *Ganoderma pseudoferreum* (Wakef) Van O. et S.

The fungus causing Wet-Root Rot, the most prominent root disease in old rubber plantations in Malaya, is commonly known locally by two other different names, and much confusion often arises as a result. *Poria* disease and *Fomes pseudoferreus*, are the two names by which the fungus causing Wet-Root Rot disease is most commonly known, but the correct scientific name for the fungus is *Ganoderma pseudoferreum*, the other names being synonyms.

The constant loss of stand, with a large decline in yield per acre, as a result of the ravages of this root disease in old rubber areas is now being clearly recognised in Malaya, and many estates have reached the position where quite large acreages have had to be abandoned because these acreages have become uneconomic units under the present conditions, owing largely to root disease losses. This fact has stimulated great interest in replanting and rejuvenating schemes with a view to supplying these areas with high-yielding bud-grafted material, and a long list of estates can be given on which this work is being undertaken.

A special bulletin, No. 3, of the Rubber Research Institute of Malaya was published in November 1931 in which the whole subject was dealt with in a comprehensive manner. The records obtained by complete root exposure methods showed that 56—60 per cent. of trees with diseased roots were to be found in diseased areas and that in 30 per cent. of the diseased trees the fungus was found only in the smaller lateral roots, and would most probably be missed if only a partial root exposure, 4—6 ft. in diameter around the stem was undertaken. This suggestion is supported by recent work in areas being felled for the pur-

pose of replanting. In such areas, where the trees are roughly removed by jacks, the number of obviously diseased trees usually totals over 20 per cent. There must be a fair percentage of recently affected trees with the disease present in the smaller lateral roots only, which cannot be tallied easily by this rough and ready method and there is no doubt, in the writer's opinion, that the root disease percentage in these areas is usually nearly 50 per cent. Badly diseased areas of ¾ of an acre in extent have been worked over which showed a root disease percentage of over 90 per cent. Similar experiences have been reported from Sumatra.

Several important new findings were made during 1931 which it is hoped to follow up during 1932, if opportunity permits. The most important finding is the discovery of this disease in trees not over 3½ years old and the characteristic response of vigorous roots, even in young trees, to the fungus attack. This response is the development of large numbers of adventitious roots from the healthy portions of the root which have not been reached by the intruding fungus. The production of masses of adventitious roots by the large roots of old trees is a very common feature and it occurred to the writer that therein lay the clue to two peculiar features of this disease. These features are :—

(*a*) The disease did not become prominent before the 8th—10th year.

(*b*) The best looking and best yielding trees were the first to be attacked.

The lateral roots of a tree 5½ years of age were found attacked, and the response was found to be similar to that in older trees, the attacked roots producing a large number of adventitious roots; the actual result therefore, from the time of infection onwards, is an increase in area of the absorbing portion of the root system. This goes on progressively, the increase in absorbing area due to the development of adventitious roots being reflected in better leaf canopy development and later on, when tapping is commenced, in higher yields. This position is maintained until the fungus has affected so much of the root system that absorption cannot be maintained at the usual rate. This will happen when the fungus has travelled up one or two of the main laterals and passed into the stem. Because of the reduced rate of absorption the tree begins to show signs of disease in the upper branches and when the roots are carefully inspected the typical Wet-Root symptoms can usually be found.

The writer holds the opinion that Wet-Root rot disease will probably be found in the very early history of new plantations, in the near future. This is a most important finding as it demonstrates that adequate control is not likely to be obtained unless systematic measures against this disease are put into operation in the earliest stages of the plantations.*

The most important factor influencing the spread of Wet-Root rot is careless or unscientific thinning-out. In all the worst cases, the trees have been cut at ground level, the stem and branches removed while the tap root and laterals

* During a recent tree-to-tree root inspection over an area of 40 acres with trees 3¼ years old, ten undoubted cases of "Wet-Rot" caused by *Ganoderma pseudoferreum* were found.

are allowed to rot *in situ*. This system provides ideal conditions for a disease which spreads by direct root contact. Due regard to this fact must be paid in any future policy which depends on the establishment and maintenance of high yielding areas of bud-grafted rubber and one of the important guiding lines in such a policy must be a minimum amount of thinning-out of trees; if any thinning-out is undertaken it is essential that tap-roots and lateral roots be taken out as completely as possible if the position with regard to Wet-Root rot is to be improved in the developing plantations of the future.

Root Disease caused by *Fomes lignosus*: Klotsch.

Many unexpected results have been obtained over the last year in the investigation of this disease, and these results necessitate full confirmation on a larger scale. The legitimate deductions to be made from these experiments at the present date are :—

(*a*) Up to an age of three years, rubber trees are exposed to a greater risk of infection from *Fomes lignosus* in an area from which surface timber and jungle stumps have been removed than in an uncleared area.

(*b*) It is probable that the incidence of the disease in a young clearing is less under a cover crop than in clean weeded areas.

(*c*) Up to the age of three years the incidence of the disease on rubber trees is probably least where secondary jungle has been allowed to grow up, as a natural cover.

(*d*) Application of lime encourages the growth of the fungus.

(*e*) An aqueous solution of copper sulphate at a 2 per cent. strength is able to kill superficial mycelium upon the roots of rubber trees if it comes into direct contact with the mycelium.

(*f*) It has been found that fructifications of *F. lignosus* spore freely at certain seasons which probably occur after periods of heavy and continuous rain.

(*g*) The mycelia isolated in pure culture from (i) the fructifications (ii) the rhizomorphs (iii) from diseased wood are identical in microscopical vegetative characters, but that from spore cultures, has a slower growth rate and produces more aerial mycelium on nutritive media.

(*h*) Rhizomorphs and fructifications can be obtained under experimental condition in the laboratory from naturally infected material. The most profuse rhizomorph formation takes place in the absence of light; when exposed to light there is a tendency to form fructifications. Fructifications developed in the laboratory can produce spores even in the very early stages of development.

Mouldy Rot caused by *Sphaeronema fimbriatum* (E & H) Sacc.

Up-to-date there are many gaps in our knowledge in relation to Mouldy Rot disease. There is no doubt that it is the most serious above-ground disease

of the rubber tree in Malaya, and the situation in native holdings with regard to this disease is extremely unsatisfactory.

In addition to *Sphaeronema fimbriatum*, there are two other species of the same family found on rubber trees. Investigations have shown that the "*Sphaeronema* pycnidium" is not always an imperfect fruit-body containing pycnospores but is sometimes a perfect fruit body containing ascospores and thus some of the *Sphaeronema* species have been wrongly named and should now be placed in the genus *Ceratostomella*. This finding has been confirmed with one of the rubber *Sphaeronema* species though not as yet with the species causing Mouldy Rot. However, it is fairly certain that a similar finding will be made with the fungus causing Mouldy Rot. Pure cultures have been obtained and when the required fructifications develop an attempt will be made finally to confirm the status of the Mouldy Rot fungus. In addition, an attempt will be made to fill in some of the existing gaps in relation to the method of infection and host-parasite relationships.

During August last, arrangements were finally completed for running systematic tests on various proprietary disinfectants which might prove useful in the control of Mouldy Rot. The terms of testing were set out with a view to establishing a "White List". The work has been carried on successfully over the last three months and many substantial facts have been obtained as a result. Three additional disinfectants have successfully passed the required tests and several more remain to be tested.

Recent investigations have revealed certain interesting pointers in the matter of treatment. The usual Mouldy Rot symptoms have been found to disappear very rapidly during a spell of dry weather; after three days, without rain but with bright sunshine, a block of trees with 60 per cent. of the trees infected showed practically no signs of the fungus on the tapping panel. It is obvious from this result, that field tests cannot possibly be continued during dry-weather periods. A definite endeavour should be made to clear bad Mouldy Rot areas during dry-weather periods; if this could be done it is probable that control of the disease during the wetter months of the year would be rendered easier and less expensive.

The question of periodic tapping is of some importance in areas badly infected with Mouldy Rot. A fundamental point in the standard treatment of Mouldy Rot is the cessation of tapping for one month. Thus, if an alternate monthly system of tapping was arranged, there should be little difficulty in controlling Mouldy Rot, even in badly infected areas. This has been adopted on one estate and slightly infected trees are painted over the recently tapped surface with Lime Wash. There is no doubt that a great improvement has been effected by this method.

Again, the A.B.C. system of tapping can often be arranged to help in control of Mouldy Rot where an estate is bordered with small Asiatic holdings containing rubber trees badly infected with Mouldy Rot. September to December are the months during which Mouldy Rot spreads rapidly, because of the more constant rainfall

during this period of the year. Therefore, during this period, the tapping on the A.B.C. system should be arranged so that the trees nearest the badly infected small-holdings areas should be out of tapping during the September—December period. By taking advantage of this suggestion, one estate has cut down expenses on Mouldy Rot treatment very extensively.

The special feature in relation to this disease was an arrangement agreed to by the Department of Agriculture to supply planters with disinfectant for the treatment of Mouldy Rot in small-holdings adjacent to their estate; they in turn agreed to supervise the correct mixing. Such an arrangement would help considerably in the control of the disease if it can be worked successfully.

The enforcement of the regulations of the "Pest and Diseases Enactment" is difficult during depressed periods such as the present for the small-holder is forced to tap continuously in order to obtain money for food. But attention must be drawn to the present anomalous position which has now arisen. Owing to lack of funds little or no attention to treatment of the disease is being given on small holdings. Under such circumstances the "bark position" on infected small holdings goes from bad to worse and an endeavour has been made to improve the condition of the bark by frequent paintings with weak disinfectant solutions, after tapping has been done. Even if painting with a weak disinfectant solution is done faithfully after each tapping, the fungus is not prevented from further development for if painting is stopped for two to three days, the fungus becomes prominent again on all the trees previously affected. After much consideration, the writer is doubtful whether the bark position is improved or not, but the loss of control of the fungus which will result from the adoption of these methods is bound to lead to misunderstanding. From a pathological point of view such control measures cannot be recommended, and the dangers of the situation are all too obvious to those estates which have not yet been troubled by Mouldy Rot disease.

Further Research Items.

The following list gives the varied subjects which have come under review recently and to which additional observations of interest have been made.

(*a*) Lightning injury on rubber plantations.

(*b*) Bud-grafting on old stocks and protection of pruned surfaces with Asphaltum-Kerosene mixtures.

(*c*) Host-parasite anatomical relationships in *Ganoderma pseudoferreum* (Wakef.) Van O et S. and *Sphaerostible repens* B & Br.

(*d*) Internal Bark fissures.

(*a*) Lightning in relation to diseases of rubber trees has been considered of relative unimportance up-to-date. As a result of many years work the writer has shown that lightning is probably the most important primary agent of disease in coconut plantations in Malaya and it seemed possible that lightning effects might be of some importance in relation to rubber tree diseases.

Investigations made during the year have proved conclusively the soundness of this view. Lightning effects in rubber plantations are quite definite and can be considered conveniently under two headings.

(i) Lightning effects in young plantations associated with "Die-back".

(ii) Lightning effects in older rubber, (over four years), associated with Claret-Coloured Bark Canker at the collar.

The general features associated with (*a*) have been referred to on previous occasions by other investigators but no exact data have been forthcoming. The association of Claret-Coloured Bark Canker at the collar with lightning effects, is an entirely new departure and has not been recorded previously. A comprehensive article on lightning effects and diseases in coconut and rubber plantations is ready and has been submitted for publication. The subject matter is of considerable scientific interest because of new findings which lead to clarification of obscure views.

(*b*) There are few difficulties attached to the practice of bud-grafting if the stocks are not more than 18 months old. Difficulties arise, however, when well grown stocks, over 2½ years of age, are used, because when the stock is cut back a large wood surface is exposed. Budding on trees four to five years old has been common during the past year or two and when the large stocks are cut back a wood surface of large dimensions is exposed which will take years to close over naturally by callus formation, and unless great care is taken "Die-back" fungi gain an entry and grow downwards to a level below that of the Bud-Patch. Cases have been found where the "Die-back" fungi had penetrated to ground-level and there is no doubt that such cases must succumb finally. The trouble occurred on such a large number of estates that it was considered necessary to issue " Standard Instructions for protection of the pruned surface ".

In connection with the budding operation Asphaltum and Kerosene mixtures are the standard recommendation for covering the pruned surface. It has been definitely proved that the Asphaltum-Kerosene mixtures are not ideal covers for this purpose. *Diplodia* pycnidia have been demonstrated actually developing in the interior of the Asphaltum-Kerosene layer covering the pruned surfaces. However, this still remains the most useful cover, more especially if used in conjunction with a strong disinfectant solution which should be painted over the exposed surface a few hours before the application of the Asphaltum-Kerosene mixture. Further experiments will be carried on to obtain a better cover if possible.

(*c*) The difficulty of correct diagnosis has been experienced by all plant pathologists working on perennial crops. The early symptoms of root diseases of rubber trees are often very difficult to identify correctly and definite aids to correct diagnosis would be welcomed. Microscopical sections of the bark tissue of the roots rubber trees attacked by *Fomes pseudoferreus* Wakef. and *Sphaerostilbe repens* B & Br. show typical appearances by means of which a correct diagnosis can be made. These observations will be published when opportunity offers.

(*d*) This particular affection of internal fissures was first noted in Malaya in 1929 and attention was drawn to the apparent similarity of the symptoms with Black Stripe disease. Several cases have been examined during the year and they were all found under exactly similar conditions. The estates on which the symptoms were found had poor bark reserves on their old trees and for this reason tapping had been commenced on previously untapped bark, 18 inches to 2 feet above the bark panel which had been tapped for many years past. The symptoms became noticeable in two months' time on the newly opened panels. The explanation is still obscure, but the discovery of this association should prove of value if an opportunity for further investigation presents itself.

Other Diseases.

Pink disease was troublesome in some parts of North Perak and Kedah during the first half of the year. Black Stripe and Brown Bast were of little account. The root diseases caused by *U. Zonata* and *Sphaerostilbe repens* were of the usual order and call for no comment. The expected Oidium attack failed to develop owing to weather conditions, unfavourable to the fungus, prevailing during the year. Consequently, a comprehensive scheme of sulphur dusting experiments, which had been arranged during the months of January and February, had to be abandoned.

This article deals primarily with rubber tree diseases but this opportunity should not be missed of drawing attention to a cockchafer grub plague which is under investigation on one estate in Malaya. The occurrence of this grub plague has, fortunately, been confined to an area of less than 100 acres in extent, of 14 year old rubber. The presence of the grubs was first reported in August 1930. These grubs have been known to attack seedling rubber plants on a small scale but there is no previous record of a mass attack on mature rubber where thousand of grubs have been removed from the soil without any apparent decrease in numbers. The grubs eat away the cortical tissues of the tap and lateral roots down to the wood and a badly attacked tree undergoes successive defoliations with a resulting decrease in yield. The problem is one of great entomological interest and is being closely followed up.

THE MALAYAN RUBBER INDUSTRY IN 1931

BY

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The following general review of the condition of the Rubber Industry has been prepared from material compiled for the Annual Report on Agriculture in Malaya.

The sale price of rubber during 1931 reached a new low level, the average price for first grade smoked sheet being 3.13d. in London, 6.07 cents (gold) in New York, and 9.78 cents (Straits) in Singapore. The rise in price shewn in the London and Singapore markets during the last three months is due to the British departure from the gold standard.

The majority of estates steadily reduced the cost of production by means of rigorous economy, but this was followed by further falls in price, so that at the end of the year only a comparatively small number of estates could show a favourable balance.

Notwithstanding this pressure, up to the end of the year only a comparatively few large estates had ceased production, and the effect of the low prices in reducing production has been slow. A large number of estates only maintaind production in the hope that shortly the situation might be relieved by the introduction of restriction in some form.

Year	World Production Tons	World Consumption Tons	World Stocks* Tons	Average Price s. d.
1922	379,920	394,527	205,840	0 $9\frac{1}{4}$
1923	412,771	439,407	163,097	1 $3\frac{1}{4}$
1924	421,217	458,252	108,950	1 $1\frac{7}{8}$
1025	516,076	551,244	76,383	2 $10\frac{3}{4}$
1926	614,778	533,915	149,026	1 $11\frac{3}{4}$
1927	605,196	589,128	193,146	1 $4\frac{1}{4}$
1928	649,674	667,027	122,828	0 $10\frac{1}{1}\frac{1}{6}$
1929	863,410	785,475	228,572	0 $10\frac{1}{4}$
1930	821,815	684,993	366,034	0 $5\frac{1}{1}\frac{5}{6}$
1931	799,000†	673,000‡	556,075§	$3\frac{1}{8}$

* Total of stocks at three main centres—U.S.A., United Kingdom, and Singapore and Penang.

† Vide Rubber Growers' Association Bulletin, February, 1932.

‡ Estimated world absorption of crude rubber by manufacturers, (Rubber Growers' Association Bulletin, February. 1932, page 103).

§ Total of stocks on hand and afloat for the tree main centres—U.S.A., United Kingdom, Singapore and Penang (Rubber Age, February 10, 1932). The total stocks on hand and afloat in the world are estimated at 629,276 tons.

With consumption dropping sharply during the industrial depression, world stocks have risen in 1931. The situation which rubber shares with so many other commodities, but in more acute form than most, is shewn in the above statistical summaries taken from W. H. Rickinson and Sons' "World Rubber Position, 1931".

Areas Under Rubber in Malaya.

The total area under rubber in Malaya at the end of 1931 was approximately 3,070,000 acres.

Rubber Production in Malaya.

The production of rubber in Malaya for the year 1931 is estimated to be 434,857 tons. Of this total 239,435 tons represent the production on estates of 100 acres and over and 195,422 tons the production of holdings less than 100 acres. At the average export price per ton of $227.75 the total value is $99,038,682. The production is sub-divided as under:—

	Production of estate over 100 acres.	Production of estates under 100 acres.
Federated Malay States ...	141,457 tons	105,378 tons
Straits Settlements ...	24,766 ,,	25,346 ,,
Unfederated Malay States ...	173,212 ,,	63,698 ,,
	239,435 ,,	195,422 ,,

New Plantings in 1931.

The area of new planting is estimated to be as follows:—

Federated Malay States ... 8,307 acres.
Straits Settlements ... 822 ,,
Unfederated Malay States (Information not available).

In pursuance of the decision reached in 1930, no fresh alienations of land have been made, consequently additions to the planted areas so far as is known have since that date only occurred on land previously alienated.

Conditions on Estates.

Slump conditions have undoubtedly retarded progress on many estates in relation to budding programmes, replanting schemes and amelioration of soil conditions, especially in the application of fertilisers. Except in a few instances, estates have been well maintained, and crop yields have shown little or no sign of diminution. As is to be expected, increasing attention has been paid to the possibility of making economies in production, and this has been particularly

marked in factory practice in which considerable economies have been found possible particularly in relation to the manufacture of smoked sheet rubber.

Tapping costs have also been considerably reduced on many estates. In 1930 it was stated that it had been possible to produce crops at the low F.O.B. cost of 10—12 cents. During 1931 these costs have been almost halved on many estates, although it must be admitted that little or no allowance has been made for improvements in general estate practice, while profits are nil.

Experimental work in progress on several estates had to be stopped, while it is not possible for estates contemplating manuring programmes to initiate experimental work. A number of experiments have, however, been laid down by Imperial Chemical Industries and Malayan Fertilisers Limited.

A comprehensive article by the Soils Division of the Rubber Research Institute shows that, generally, the manuring of well-grown rubber trees having a yield of above 400 lbs. of rubber per acre usually gives no notable increase of crop, while it is common to obtain useful increases on areas yielding between 200 and 300 lbs. of rubber per acre.

In the case of trees having poor foliage and bad bark, considerable improvement of both foliage and bark has been observed as the result of manuring, but yield increases have been considerably delayed in appearing. The results indicate that the trees have a definite optimum yield which is not materially increased by the application of fertilisers, so that response is only obtained when the yields are below this optimum.

Increased attention has been paid to soil conservation by the cultivation of leguminous and other cover crops and to mechanical methods of preventing soil erosion. The growth of cover crops under rubber has continued steadily to extend, while practice in relation to the prevention of soil erosion by other means such as silt pitting, contour draining and so forth has greatly advanced in the last few years. On well managed properties the situation in relation to the prevention of soil losses by erosion may be regarded as moderately satisfactory.

Forestry Method of Cultivation.

Interest was aroused during the year in the so-called forestry method of cultivation of rubber due particularly to the pioneer work of one estate in Pahang. The principle underlying this method is to allow spontaneous growth, consisting very largely of Hevea seedlings mixed with other forms of natural growth, to grow up unchecked amongst the rubber trees. It is claimed that this type of growth, while doing no harm to the main crop, conserves surface soil by preventing erosion, and lowers the temperature of the soil to a point such as exists under jungle conditions, and so lessens oxidation of organic matter in the soil. It is claimed that by this method conditions both of soils and trees on rubber estates can be greatly improved; in so far as concerns the latter the thesis apparently is that as rubber itself was originally a forest tree the introduction of forest conditions in its cultivation may be the correct procedure. It may be pointed out, however, that as all plants have their origin in some wild form, the

argument is logically capable of extension to any form of cultivation, although in the case of rubber there may be certain special factors which are particularly influenced by such conditions.

On the other hand, it would seem that a point may arise when competition from other forms of vegetation affects yields and growths and also gives rise to difficulties by hindering access. In general, the encouragement of natural covers on permanent cultivation is an interesting development. It seems arguable, however, whether the best results might not be likely to be secured by the periodic cutting back of the growth so engendered; it may be pointed out that this type of procedure was advocated so long ago as 1904 by the late Sir Francis Watts in relation to cocoa and lime cultivation in the West Indies. In any event, future developments along these lines will be watched with interest.

Budding of Rubber.

Records of high yielding mother trees of various estates have been continued, and a large number of seedlings at the Rubber Research Experiment Station have been budded with budwood from these trees for the development of new Malayan clones.

Tapping has been continued on the Pilmoor Estate clones, while several methods of tapping have been applied to groups of trees from the very promising Malayan clone Glenshiel I.

Budding programmes have been continued on a number of estates although the slump has stopped such development in many cases. It is estimated at the end of 1931 there was a total area of over 134,000 acres of budded rubber in Malaya. Importations of budwood and superior planting material from the Netherlands East Indies and other outside sources are as follows:—

Budwood	...	6,039 metres
Special Seed	...	5,000

These show a considerable decrease on the figures of previous years due largely to the establishment of multiplication nurseries in Malaya and the increasing use of promising Malayan clones.

Mono-clone planting, i.e. the planting of single clones in blocks of a suitable area, continues to find favour.

Various experiments on different methods of budding and budding of older stocks at different heights have been continued at the Rubber Research Institute Experiment Station, while test tapping on young budded trees both at the Experiment Station and on several estates have been continued with the object of correlating the yields with subsequent systematic commercial tapping when the trees reach a tappable age.

Manufacture.

In relation to manufacture, it has been shown that considerable variability still exists in the product. The influence of the carbohydrate (sugar) consti-

tuents of latex has been investigated, and in addition to the isolation of quebrachitol (1 - methyl inositol) from the latex and its serum, investigations have been carried out on the properties of lipin isolated from latex by the Rubber Research Institute.

Increasing attention has been paid to improvements in factory machinery and equipment especially in the preparation of smoked sheet. As a result of the work of a number of estates, batteries of light sheeting machines in cascade or file formation, capable of outputs of from 2,000 to over 3,000 lbs. of dry rubber per hour have been developed and are in use on a number of estates.

The saving in capital costs and running expenses on large estates as a result of the investigation will be very considerable, since only a small factory with a battery of five or six light sheeting machines is sufficient for an area of 6,000 acres or more.

Improvements in the ventilation and design of smoke houses and smoke house fire boxes is also resulting in economies in consumption of wood fuel combined with more rapid drying and smoking.

The higher cost of preparation of thin pale crepe is tending to cause a reduction in the output of this grade, since the extra premium is not sufficient to cover the extra cost of manufacture, but it is anticipated that in due course it may be found possible to prepare a thin air-dried sheet as a substitute for thin pale crepe at about one-third the cost, so that heavy machinery in only a few central factories in each district will be required for treating the 10—15 per cent. of lower grade rubber.

The increase of export of preserved latex has continued and the extensive application which this form of product is finding in Europe and America leads one to expect that a rapidly increasing demand therefor will in due course ensue.

Small Holdings.

In view of the importance which attaches to production on small holdings as a factor influencing the total production of rubber in the East, interest in the question has continued to increase. Throughout the year regular surveys of the conditions on small holdings have been carried out by the Department of Agriculture and quarterly reports on the position of such holdings have been published in the *Malayan Agricultural Journal*. These reports are undertaken at the special request of the Rubber Growers' Association. The data collected by the Statistical Division of the Department of Agriculture and the Department of Statistics place the production in tons on small holdings for the last two years at the following figures:—

		1930	1931
Federated Malay States	...	110,206	105,378
Straits Settlements	...	38,770	25,346
Unfederated Malay States	...	66,113	63,698

It would thus be seen that the production on small holdings shows a slight diminution as compared with 1930, the decrease being most marked in the Straits Settlements and least in the Unfederated Malay States.

Although tapping on the share system was still common on small holdings, the number of owners who tapped their own trees increased steadily. Tapping was continuous and bark removal excessive on holdings of which the owners had no other source of livelihood.

Owing to the suggestion that on small holdings excessive tapping was the rule, proposals were put forward during 1930 for undertaking a regular survey in this respect. These proposals materialised during the year 1931 and a special grant of $10,000 was made from the Rubber Research and Propaganda Fund for the purpose. By the end of the year these investigations had been carried sufficiently far to enable a certain number of deductions to be made therefrom; it was found that the consumption of bark on the small holdings examined was considerably less than had been anticipated. No reliable data are yet available on the subject of the ratio of bark consumption to bark renewal. Systems of measurements have been worked out and put into operation, but no figures can be supplied until a lapse of one year from the commencement of the work.

Some interesting data have become available in relation to planting distances on small holdings, which shows that out of a total of 35 holdings examined the distances ranged between 8 x 10 feet as a minimum up to 18 x 18 feet as a maximum.

Pests and Diseases.

No special outbreaks of disease have occurred during the year.

Mouldy Rot, caused by the fungus *Sphaeronema fimbriatum*, has, however, been very prevalent during the wet season on small holdings. The disease spread considerably owing to the migration of dismissed tappers from infected areas to other localities previously healthy. Its control, especially in the wetter weather, also proved difficult, since owners could not usually afford to cease tapping or even in many cases to purchase efficient disinfectants, although rendered available to them at cost price through the officers of the Department of of Agriculture.

During the year, the Department of Agriculture in conjunction with the Rubber Research Institute of Malaya organised a scheme for the testing and official recognition of fungicides which could be safely used in the treatment of Mouldy Rot, and facilities were provided whereby owners or agents of different fungicides could have their preparations tested at the Rubber Research Institute; if the results of the test are satisfactory, the fungicides are included in a "white list." When prescribing treatment on holdings affected by Mouldy Rot the Department of Agriculture will enter on the notices served only the names of preparations which have been approved by test at the Rubber Research Institute and included in the "white list."

The incidence of leaf mildew disease caused by the fungus *Oidium Heveae* was negligible, probably owing to the regular rainfall after the normal wintering season, and on this account no further investigations were carried out on the control of this disease by the dusting of sulphur.

Considerable attention has been paid to the two principal root diseases—*Fomes lignosus* and *Ganoderma pseudoferreum* (*Fomes pseudoferreus*). A special bulletin was published by the Rubber Research Institute during the year dealing with the problem of root diseases in mature rubber, especially in relation to replanting of such areas with high yielding material which is considered to be an economic proposition. It is considered that the incidence of root diseases probably is the limiting factor to the life of plantations established on virgin jungle soils, and the economic life under such conditions has been placed by the Pathologist of the Rubber Research Institute at about 30 years.

During the year further investigations on *Fomes lignosus* have thrown new light on the occurrence of this disease. It has been shown that the treatment of the soil by liming is of no value, while treatments with certain fungicides, if direct contact of the fungicide with the mycelium on the plant is effected, is useful.

A grub or caterpillar of a cockchafer is reported as causing considerable damage on one estate; the disease is being investigated.

Helminthosporium Heveae (Bird's Eye Spot Disease) and Mites caused damage particularly to young plants and seedlings in nurseries, while grasshoppers have caused a certain amount of damage to young seedlings and budded plants. It is interesting to note that the latter appears to have shown particular preference for one clone only.

Conclusion.

The Rubber Industry of Malaya is passing through the most severe vicissitude which it has so far experienced, or probably is ever likely to experience.

Drastic retrenchment of expenditure and curtailment of development is in these circumstances inevitable. Nevertheless, progress is discernable in many directions and it seems reasonable to believe that when the industry does eventually emerge from its present difficulties, a standard of efficiency of production will have been shewn to be capable of achievement which was undreamt of in the prosperous times which formerly prevailed.

CONDITIONS OF SMALL RUBBER HOLDINGS IN MALAYA

First Quarter, 1932.

Rainfall.

In January the dry weather commenced earlier than usual with the exception of Kedah, where rain continued to fall until the middle of the month. High winds were experienced during January throughout the Peninsula, with occasional North-East winds in Selangor and Negri Sembilan. In the first half of February the rainfall was practically restricted to Perak North, where it was above the average, while in the latter portion of the month thunderstorms of varying frequency and intensity were experienced generally.

The first half of March was dry but the second half brought a heavy fall in Pahang, which occasioned somewhat severe flooding there and the precipitation was everywhere above normal.

Prices.

The following table shows the range of prices received by small-holders for rubber sold to local dealers, and for comparison with these, the average Singapore price for the month for standard sheet, together with the price quoted at the end of each month, in Singapore and Penang, by large dealers for small-holders' rubber. All quotations are given in Straits dollars and cents for the price per picul, i.e. 133⅓ lbs. The highest prices in January and possibly in February were the result of speculation by local buyers at the possible introduction of restriction.

It must be borne in mind when comparing the above figures, that the quotation for Singapore smoked sheet is the average monthly price, whereas other quotations give the range of prices over a number of buying centres. The following shows the range of prices in dollars per picul for smoked sheet in five of such centres in Negri Sembilan for the month of January.

Seremban $10 to $13.50
Kuala Pilah $10.50
Rembau $10 to $13
Port Dickson $9.50 to $11.50
Jelebu $11 to $14.

Tapping.

The customary decrease in tapping during the padi harvest season has been observed everywhere in padi-growing districts. In Perak, Selangor, Penang and Province Wellesley and Negri Sembilan there has been a general tendency to neglect rubber wherever owners have any alternative agricultural resources, particularly during the wintering period when the yields obtained have hardly justified tapping operations. Chinese and Chettiar-owned holdings of a larger size are still reported generally to be reducing the areas under tapping, and in several cases to be closing down entirely.

Table of Rubber Prices.

1st Quarter, 1932.

	Singapore Standard sheet Average	Singapore for small holder's rubber at end of month	Penang for small holder's rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Pahang	Johore
				JANUARY							
Smoked sheet.	(9.43 lbs.) 12.57	11.80	11.20-13	11.25-13.25	11-14	8-13	9-12.50	9.50-14	10-14	9.40-12.20	8.50-13.75
Unsmoked sheet.		10.50	9-10	11-12.25	8-12	8-11	7-10	7.50-12.50	8-12	10.45-13.20	6-11
Scrap		4	5-6	6-6.50	5-7	3-6	2-6	2-7	4-5	4-7	2-6
				FEBRUARY							
Smoked sheet	(8.18 lbs.) 10.91	9.50	—	9.50-10.50	9.50-11-20	7-10	8-12.50	7-11	8-10	9-11.80	7-10.30
Unsmoked sheet		8	8-9	8-11.50	7-10.50	6.50-8	5-10	6-9.50	7-9	7-10	5-9
Scrap		2.50	4-5	5-6	2.50-7	2-4	2.50-5	2-6	3-5	—	1.50-5.50
				MARCH							
Smoked sheet.	(6.39 lbs.) 8.52	5.50	—	8-9.80	6-9	5-9	5-9	4-8.75	5-3	6.20-11	4.20-8.70
Unsmoked sheet.		3.75	5.30-6	6.75-8.50	5-8	4.50-6.50	3.50-6	3-7.50	4-6.50	4-9.60	2-7.50
Scrap		.60	2-3	4-5	2-4	1-3.50	1.50-4	1.50-4	2-4.50	1-6	1.-3.50

Reports from Selangor, Penang and Province Wellesley state that in cases where the owners are entirely dependant on rubber as a livelihood, somewhat excessive tapping has been observed in an effort to produce more rubber to counter-balance the low prices obtained.

The work of investigation on bark consumption is continuing.

Since the publication of the report for the fourth quarter of 1931, a further twenty-eight holdings have been brought under observation, bringing the total number of holdings on which monthly bark consumption measurements are now being taken up to ninety. The officer in charge of this work, who is at present engaged in taking measurements of the reserves of tappable bark on each plot, has been unable to prepare a further detailed report, but he states that no very marked alteration in the rate of bark consumption, or in the general position of affairs on these selected holdings has been observed.

Records of yields are taken each month on all the above small-holdings; it is not, of course, possible to publish figures of the average yield per acre per annum, which could be regarded as at all accurate, until a complete series of twelve monthly yields have been obtained. During the period of October to December 1931 yields per acre per month ranged between 28 lbs. per acre and 123 lbs. per acre.

Postponement or Acceleration of Bringing Young Rubber into Tapping.

The position with regard to this remains unchanged throughout the Peninsula during this quarter; practically no young rubber was brought into tapping.

Root Diseases.—Above-ground observations are made by the Bark Recorder of all trees on which bark measurements are being taken: he reports that out of a total of 8,300 trees examined by him in lots of 100 consecutive trees on 83 widely distributed holdings, 49 cases of root disease were found as follows:—33 cases of *Ustulina Zonata,* 4 cases of *Ganoderma pseudoferreum,* 11 cases *Fomes lignosus,* and 1 case of *Sphaerostilbe repens,* making an average incidence of 0.59 per cent.

Mouldy Rot.—The dry weather during the wintering season caused the usual decrease in infection, which was, of course, materially aided by the circumstance of many holdings being untapped during this quarter.

Oidium Heveae.—Sporadic outbreaks of this disease have been observed in Muar, Batu Pahat and Segamat in Johore and at Umbei and Serkam in Malacca: the onset of the rains in the middle of March has been responsible for an immediate decrease in its incidence in all these areas. *Oidium Heveae* has been observed to attack both the flowers and young leaves in practically all rubber areas in Province Wellesley and was reported for the first time at Penang Island.

Budgrafting.

So far the only instance of budgrafting reported among small-holders, is that of an area of nine acres of budded rubber owned by a Chinese in Negri Sembilan.

Grades of Rubber Made.

Marketing methods have remained practically unchanged during this quarter; unsmoked sheet still appears to be the most popular form of rubber sold by small-holders, more especially by the Malays. Owing to the necessity for obtaining ready money, it is the prevailing custom to sell this unsmoked sheet in this form one to three days after harvesting; the dealers frequently pay a small advance on this, making the final payment only after the sheet has been completely smoked by them. A reduction is, of course, made to cover the cost of smoking.

The preparation of slab rubber in large quantities is still practically confined to the districts of Krian and Taiping in North Perak and to Kuala Langat in Selangor: in the latter District about 12 per cent. of the total small-holders' rubber is now sold in this form. The preparation of small quantities of slab rubber has recently been observed in the Districts of Klang and Ulu Selangor.

The range of prices per picul, during the quarter, for this grade of rubber in the following centres was, Krian $1.50 to $6, Taiping $5 to $6, Kuala Langat $2.50 to $5, Klang $3.25 to $5, Ulu Selangor $2 to $7.

The following table shows the relative percentage of the sale of smoked, unsmoked sheet, "slab" and scrap, in Districts where records have been taken.

District.		Percentage of smoked sheet.	Percentage of unsmoked sheet.	Percentage of 'slab'.	Percentage of scrap.
Kuala Langat	...	15	68	12	5
Klang	...	90	10	—	—
Kuala Selangor	...	100	—	—	—
Ulu Selangor	...	86	14	—	—
Kuala Lumpur	...	30	60	—	10
Ulu Langat	...	76	18	—	6
Malacca Central	...	—	79	—	21
Alor Gajah	...	—	85	—	15
Jasin	...	—	63	—	37

Tendency to Abandon Rubber Cultivation for Alternatives.

Reports have been received of the cutting out of very small areas of rubber in Selangor and Perak Central during this quarter, in order to make room for the cultivation of food crops. This has occurred chiefly in the immediate neighbourhood of large towns, in areas where all the available land is devoted to rubber. Increasing attention is being given to the cultivation of foodstuffs on land alienated for this purpose on temporary occupation licenses. Greater care is being given to land planted with coconuts and the formerly neglected mixed orchards containing coconut and various fruit trees which are frequently found in the neighbourhood of the dwelling houses especially in the more remote country districts.

There has been no report of newly planted areas during this quarter.

Planting Distances

Observations on the planting distances on small-holdings are now being taken in many districts: the minimum planting distance observed to date is 7 feet x 7 feet which is the average on 10 holdings in Banir in Perak South. The following table shows the average distances measured on eighty-three of the widely distributed holdings where bark consumption observations are being taken: these are listed under the ages of the trees on these holdings for the purposes of comparison.

Age of Trees.	Percentage of holdings of this age.	Average planting distances.
10 to 12 years	12	16 ft. x 17 ft.
13 to 15 „	23	14 ft. x 14 ft.
16 to 18 „ and over	65	14 ft. x 15 ft.

The minimum distance observed on these holdings is 8 feet x 10 feet and the maximum distance is 18 feet x 30 feet.

H. D. M.

Reviews.

Plantation Sheet Rubber Manufacture.

Planting Manual No. 3 by R. O. Bishop, published by the Rubber Research Institute of Malaya, Kuala Lumpur, February, 1932, 61 pages, 48 illustrations and diagrams and 8 graphs, price $2/-.

This publication coming as it does at a time of urgent need for economy, is particularly valuable: its object being to supply information not only on the preparation of improved sheet rubber but on its production at the lowest possible cost.

The Manual embraces the entire process of operations from latex collection to the grading and packing of the finished product. By the inclusion of numerous illustrations the text has been reduced to a minimum.

In the preliminary chapter on latex collection, selective tapping of higher yielding trees and the commencement of tapping operations at as early an hour as possible are advocated. An interesting chart taken from an actual estate record illustrates the reduction in tapping costs effected by selective tapping with a corresponding reduction in the number of labourers employed. The importance of collecting the utmost possible quantity of clean, fresh latex is urged and as the practice of selective tapping means an increase of the area of the tapping task with a consequent delay in the collection of the latex, the use of an anti-coagulent is advocated.

A chapter is devoted to the important problem of latex transport from tree to factory, in which the subject is treated exhaustively from an economic standpoint.

Just now, when the tendency is to abandon divisional factories and, wherever possible, to centralize the work of rubber preparation, the information contained in this chapter will be found very helpful.

Under the heading of latex handling, illustrations are given showing the relative size of sand and bark particles present in the latex and the holes in a 60 mesh sieve. The absolute necessity of reducing the viscosity of latex in order to facilitate straining and the settling of sand particles, is pointed out. Diagrams illustrating suitable types of sieves are shewn in the Manual. The author points out that theoretically there should be no need for sieving if the latex, after being diluted with the necessary amount of sodium sulphite added to the bulking water further to reduce its viscosity, is allowed to stand in settling tanks before it is run into the coagulating tanks.

The supremely important procedure of coagulation is dealt with in the Manual; the desirability of coagulating latex with the maximum dry rubber content, to produce a uniform sheet as large and as thin as possible, is borne in mind throughout this chapter. A table is given in which are shewn variations in the dry rubber content of latex collected at different times of the year after standardisation to a constant density; another table indicates the

variation between *true* dry rubber content and *recorded* dry rubber content by metrolac, in latex containing different quantities of stock solution of sodium sulphite. The handling of the coagulum is a very important factor in the efficient running of a sheeting plant, and yet it may be said to be a matter which, on many estates, has not received as much attention as it deserves. All too frequently the difficulties of handling a coagulum of the correct degree of plasticity for rolling into a perfect sheet are avoided by the practice of issuing an increased amount of coagulant; but, as the author says, "There is no reason why coagulum should be made tough and untearable to satisfy the inefficiency of factory procedure." The use of a water filled trough or chute running from the coagulating tanks to the sheeting battery is recommended for the conveyance of the coagulum; this not only minimizes the possibility of damage but requires the employment of only one operator. The undesirable practice of kneading or heavy preliminary hand-rolling, which is generally necessary when dealing with tough coagulum, together with transport by hand, or the piling of coagulum into trucks, are thus avoided.

Under the chapter headed "Machining" an interesting chart illustrates the reduction of factory labour consequent on centralizing factory work on an estate which previously handled its crop in three buildings. The cost of carrying out the necessary alterations was $650 and the consequent saving of labour represents $180 per mensem.

The factors which determine the cost of sheet manufacture are, of course, the output of rubber per hour and the number of coolies required to attend to the battery; in order to effect improvements in existing conditions the Manual points out that close attention must be paid to the factors controlling the characteristics of the coagulum and the speed with which it is fed to the machines.

In most factories there is a definite delay in the transference of coagulum from one roller to another; it is recorded that the piling up of sheet between the machine has resulted in an observed case in the battery's running idle for almost as long as it was running under load.

Many suggestions are given for comparatively simple re-arrangements of the factory outlay and methods of procedure designed to increase efficiency of machinery operations, particulars of actual examples explaining the bearing these considerations have on curing costs, together with a dozen illustrations of improved types of sheet rolling batteries; a model layout of up-to-date equipment and a diagram of an ideal sheeting plant.

The final washing of sheet after it has passed through the last machine is a procedure the importance of which is frequently overlooked: imperfect washing is one of the principal sources of defects in sheet rubber.

When it is remembered that the final bath through which sheet passes, frequently contains a large percentage of serum drained off from earlier sheets, the vital importance of thorough washing will be realised.

The desirability of adequate air-drying before sheets are placed in the smoke house, is insisted upon. It is well known that sheet with a high water

content when placed in a hot smoke house is liable to develop bubbles and blisters, but if the moisture has been reduced to approximately 5 per cent. beforehand it can be dried at a temperature up to 140°F. without danger: moreover, this preliminary drainage without the use of artifical heat results in fuel economy. It has been frequently offered as an argument against preliminary air-drying that this practise creates the fault known as "rust"; this, however, the author denies, while acknowledging that air-drying does accentuate any tendency for "rust" development, a tendency which would be absent if the sheet had been adequately washed beforehand.

A chart illustrates the considerable reduction in the moisture content of sheet when hung to dry at atmospheric temperature for one day before being placed in the smoke house.

The causes which delay drying and reduce the efficiency of smoke houses are discussed. It is pointed out that it is the distribution of heat and smoke that is fundimental so that the design of furnace is important.

Full particulars and diagrams of smoke house furnaces, charts showing fluctuations in temperature in smoke houses and calculations showing what space is actually needed to accommodate a particular weight of rubber, are all given in the Manual.

The chapter on lower grades is very informative; helpful advice is given on the sorting, treatment and machining of scrap.

In the notes on Grading and Packing, it is remarked that:—

"In many instances on estates the grading of the rubber is left entirely to one or two labourers working by themselves tucked away in a building where the light is poor and the results are obscure. So much depends on the efficiency of the sorters and so much risk attends a mistake on their part that it seems worth while to supply them with standards to guide their selection—and to display such standards in a conspicuous manner so that while the sorter is at work, he will be constantly faced with what he is supposed to select."

In conclusion the author remarks that:—

"The day has already arrived when the quotations for standard sheet and remilled blanket show insignificant margins, and it seems that even these are likely to disappear as the market approaches saturation unless we can modify and adopt *our* product to the requirements of the consumer. If he does not trouble to inform us of these, we should at least aim at offering rubber of strictly *uniform quality*.

This can only be attained by precise control of all our manufacturing operations and to achieve this, a proper understanding of plantation factory work is fundamental."

H. D. M.

Nineth Report on Native Rubber Cultivation in the N.E.I.

Fourth Quarter, 1931.

The following is an abstract of the Report dated February 15, 1932, prepared by the Bureau of Agricultural Economics of the Division of Agriculture of the Netherlands Indian Department of Agriculture, Industry and Commerce at Buitenzorg, Java.

Owing to the abondonment of the gold standard by Great Britain, London and Singapore quotations are unsuitable for the purpose of studying the relation between price fluctuations and the exports of native rubber. The Java quotations, however, follow the fluctuations in price at New York.

The fall in prices continued throughout 1931. Exports of native rubber reacted rather sharply to the price fluctuations, a fact which was more evident during times of low prices. That the decrease in exports during the third quarter has been less than during the first two quarters of the year must be ascribed not only to fluctuations in price but to the fact that in the second half of the year the raising of foodstuffs demanded much labour.

The decline in rubber prices since 1928 has brought about a situation in which the native population which produces rubber has come to regard rubber as a source of additional income and not as the one and only source of income. This is particularly marked in Acheen, Tapanoeli, Sumatra West Coast, Banka and Billiton. In districts where the only other source of additional income is jungle produce, rubber exports have been maintained to a better degree.

Table I of the Report shews the monthly exports of native rubber from the Outer Provinces in metric tons, from which the figures in the following table are drawn :—

Table I.

Annual Export of Native Rubber (dry equivalent) from the Outer Provinces in metric tons.

Year	Sumatra Coast	East Acheen	Tapanoeli	Sumatra West Coast	Riouw	Djambi	Palambang
1929	14,439	522	3,389	788	8,312	22,819	15,687
1930	11,026	473	2,676	490	6,864	19,870	10,630
1931	10,837	288	1,699	299	7,417 *	21,185	10,656

Year	Binkoelen	Lampong	Banka	Billiton	West Borneo	South & East Borneo	Total
1929		56	714	113	20,315	21,429	108,583
1930	1	31	211	41	20,309	17,874	90,496
1931			42	11	19,288	16,265	87,987

* Indragiri.

The actual decrease in exports is not large compared with 1930, in spite of the fact that prices fell during the course of 1931 to about 50 per cent. of that ruling at the beginning of the year. However, taking into account that the potential production is still increasing, it must be concluded that there has been a decided decline in production of recent years compared with the estimated potential production. The following table from the Review illustrates this fact :—

TABLE II.

Potential and Actual Production of Native Rubber in N.E I.

Year	Potential production (dry) Metric tons.	Actual protion (export dry) Metric tons.	Actual production in % potential production per cent.	Average annual price for Java standard sheet at Batavia (Guilder cents) per ½ K.G.
1927	100,000	100,491	100	99
1928	110,000	91,353	83	58½
1929	120,000	108,584	90	54
1930	150,000	90,096	60	30¾
1931	200,000	89,736	45	15
1932	250,000			
1933	300,000			

From available statistics, a comparison is made of the manner in which groups of producers have reacted to the unfavourable conditions. All figures are given in metric tons :—

TABLE III.

	PRODUCTION (NET EXPORTS).					
	TOTAL			IN PERCENTAGE OF 1929		
	1929	1930	1931	1929	1930	1931
NETHERLANDS INDIA						
Estate ...	154,154	153,530	167,000	100	99.6	108.0
Native ...	108,584	90,496	89,736	100	83.3	82.6
BRITISH MALAYA						
Estate ...	249,409	236,775	243,267	100	95.0	97.5
Small-holdings	213,409	200,072	198,549	100	93.8	93.0
CEYLON	81,929	77,388	62,595	100	94.5	76.4
Rest Planted rubber ...	44,200	40.100	41,600	100	90.7	94.1

"Should we have made the foregoing comparison on the basis of "potential production, then it would have become still more evident "that in the Netherlands Indian native rubber cultivation the greatest "possible natural restriction has been effected."

The following remarks are drawn from the summary of reports received from the more important producing provinces.

Acheen and Dependencies. (Fourth Quarter, 1931). Tapping rubber has almost entirely ceased, only about 5 per cent. of the productive area being exploited. The reason for cessation of tapping was mainly low prices, but it may be partly accounted for by the demand for labour for rice cultivation. Practically no rubber trees have been cut down as there are large reserves in sub-districts available for cultivation of food crops.

Tapanoeli. (Fourth Quarter, 1931). Larger export of rubber in this Quarter is due to realisation of stocks. Tapping is done only irregularly and usually only to meet a temporary demand for money. Extensive productive areas were left unexploited.

Sumatra West Coast. Tapping declined considerably mainly owing to low prices. The quality of rubber improved in the sub-district of Loeboek Sikaping where also greater activity in tapping was shewn during the third quarter owing to the need for cash. While extensive areas remain untapped, especially those situated off the beaten track, there is no reduction in the area planted with rubber.

Riouw and Dependencies (Second Quarter, 1931). Where the population has other sources of income, rubber cultivation is of secondary importance. Tapping has declined on the whole and is done mainly by family labour.

Palambang (Fourth Quarter, 1931). A decrease in exports is explained by the appreciable decrease in tapping, partly due to the planting of the *ladangs* which demanded much labour in November, and also due undoubtedly to the low prices.

Western Division of Borneo. (Fourth Quarter, 1931.) On the whole the production was fairly constant. Accumulation of stocks did not occur to any degree. The percentage of area of productive rubber which was not being worked was estimated as follows:—Singkawang 50, Pontianak district 40, Sintang district 50, Soengei Kakap district 25, Sambas district 25. In Mempawah and Sambas the plantations were extended slightly. No important areas were lost.

Southern and Eastern Division of Borneo. (Fourth Quarter, 1931). A decrease in exports and in production is caused by low prices, the work on the *sawahs* and *ladangs* and the abundance of rain in December. Tapping is mainly in the old gardens near the villages. The planted area has not extended, but neither have any large areas been lost by fire, diseases or other causes.

Another remilling factory has been closed, so that now only one factory is still in operation. This factory and the dealers in the interior react very strongly to small price increases cabled from Singapore.

D. H. G.

AREA OF LAND PLANTED WITH RUBBER IN MALAYA AT THE END OF 1931.

State or Territory	Estates of 100 acres and over			Estates under 100 acres Total acres	Total area planted acres
	Tappable acres	Immature acres	Total acres		
Perak ...	238,420	34,716	273,136	250,166	523,302
Selangor ...	294,030	47,437	341,467	154,854	496,321
Negri Sembilan ...	217,002	55,051	272,053	81,142	353,195
Pahang ...	35,122	23,470	58,592	75,562	134,154
Total F.M.S. ...	784,574	160,674	945,248	561,724	1,506,972
Malacca ...	110,288	9,839	120,127	74,860	194,987
Province Wellesley ...	44,055	6,833	50,888	19,826	70,714
Penang Island ...	1,585	236	1,821	11,212	13,033
Dindings ...	6,700	1,220	7,920	7,667	15,587
Singapore Island ...	28,033	2,628	30,661	12,781	43,442
Total S.S. ...	190,661	20,756	211,417	126,346	337,763
Johore ...	313,385	245,623	559,008	241,747	800,755
Kedah ...	—	—	193,359	102,124	295,483
Perlis ...	Not available		2,633	4,926	7,559
Kelantan ...	„	„	33,998	58,789	92,787
Trengganu ...	„	„	10,000	20,000	30,000
Total U.M.S. ...	—	—	798,998	427,586	1,226,584
Total Malaya ...	—	—	1,955,663	1,115,656	3,071,319

Figures for Kedah are those at end of 1930, the 1931 figures not being available at present.

Certain of the above figures are subject to slight alterations.

AREAS OF RUBBER TREES BUDGRAFTED IN MALAYA.

(By size of budgrafted areas)

State or Territory.	In areas of over 1,000 acres each.		In areas of between 100—1,000 acres each.		In areas of between 10—100 acres each.		In areas of under 10 acres each.		Total Number of Budgrafted areas	Total Acreage of Budgrafted areas
	No. of areas	Total Acreage	No. of areas	Total Acreage	No. of areas	Total Acreage	No. of areas	Total Acreage		
F.M.S. :—										
Perak ...	—	—	33	7,663	41	1,766	20	95	94	9,524
Selangor ...	4	11,594	39	14,026	41	1,802	20	89	104	27,511
Negri Sembilan ...	5	11,609	39	12,065	24	1,010	7	31	75	24,715
Pahang ...	4	7,275	8	3,465	11	543	1	1	24	11,284
Total F.M.S. ...	13	30,478	119	37,219	117	5,121	48	216	297	73,034
S.S. :—										
P. Wellesley ...	—	—	1	262	5	205	6	30	12	497
Dindings ...	—	—	1	787	—	—	—	—	1	787
Malacca ...	—	—	11	2,944	9	244	6	23	26	3,211
Singapore Island ...	—	—	—	—	—	—	1	9	1	9
Total S.S. ...	—	—	13	3,993	14	449	13	62	40	4,504
U.M.S. :—										
Kedah ...	4	16,276	10	3,303	14	530	1	4	29	20,113
Johore ...	6	20,345	41	16,817	26	1,115	5	28	78	38,305
Kelantan ...	1	1,763	—	—	5	255	—	—	6	2,018
Total U.M.S. ...	11	38,384	51	20,120	45	1,900	6	32	113	60,436
Total Malaya ...	24	68,862	183	61,332	176	7,470	67	310	450	137,974

The above statement is compiled from returns submitted by estates and is believed to be approximately correct for the F.M.S. and S.S., Kedah and Kelantan. The Johore figures are compiled from 493 estates from a total of 583 Estates. Of the 90 estates which have not sent in returns, 56 are under old rubber and fully planted and the balance young rubber, Asiatic-owned and unlikely to include any considerable areas of budgrafted rubber.

AREAS OF RUBBER TREES BUDGRAFTED IN MALAYA.

(By years of budgrafting)

State or Territory.	YEAR OF BUDGRAFTING										Total area Budgrafted at end of 1931	Total area of budgrafted Rubber in Tapping
	1922 or Earlier	1923	1924	1925	1926	1927	1928	1929	1930	1931		
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
F.M.S. :—												
Perak ...	1,208	286	99	—	96	203	796	1,099	2,683	3,054	9,524	1,029
Selangor ...	1,042	695	420	169	732	1,292	1,894	8,129	8,598	4,540	27,511	2,019
Negri Sembilan ...	—	82	120	187	247	2,294	4,315	5,587	6,589	5,294	24,715	315
Pahang ...	—	—	—	—	—	5	319	3,814	3,283	3,863	11,284	—
Total F.M.S. ...	2,250	1,063	639	356	1,075	3,794	7,324	18,629	21,153	16,751	73,034	3,363
S.S. :—												
P. Wellesley ...	—	—	—	—	—	—	—	77	332	88	497	—
Dindings ...	194	—	—	85	101	250	95	—	—	62	787	128
Malacca ...	—	—	43	—	64	257	487	834	557	987	3,211	43
Singapore Island ...	—	—	—	—	—	—	—	—	9	—	9	—
Total S.S. ...	194	—	43	85	147	507	582	911	898	1,137	4,504	171
U.M.S. :—												
Kedah ...	3,332	1,815	6,351	2,441	73	301	1,596	823	1,624	1,757	20,113	10,459
Johore ...	110	1	10	38	714	2,571	2,017	11,065	8,939	12,840	38,305	89
Kelantan ...	—	—	—	—	—	—	—	32	261	1,725	2,018	—
Total U.M.S. ...	3,442	1,816	6,361	2,479	787	7,713	3,613	11,920	10,824	16,322	60,436	10,548
Total Malaya ...	5,886	2,879	7,043	2,920	2,009	2,872	11,519	31,460	32,875	34,210	137,974	14,082

NATIONALITY OF OWNERSHIP OF PLANTED RUBBER ESTATES OF 100 ACRES AND OVER, 1931.

Straits Settlements and Federated Malay States.

Territory	Non-Asiatic		Chinese		Japanese		Indian		Malay		Total	
	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres
Federated Malay States—												
Perak ...	222	236,869	79	22,071	—	—	51	11,681	15	2,515	367	273,136
Selangor ...	230	303,880	92	28,035	4	2,043	30	6,756	2	753	358	341,467
Negri Sembilan ...	167	234,377	82	23,597	8	5,667	31	6,797	6	1,615	294	272,053
Pahang ...	34	38,213	46	18,686	—	—	7	1,693	—	—	87	58,592
Total F.M.S. ...	653	813,339	299	92,389	12	7,710	119	26,927	23	4,883	1,106	945,248
Straits Settlements—												
Province Wellesley ...	21	43,398	27	7,371	—	—	1	119	—	—	49	50,888
Dindings ...	7	5,653	8	1,712	—	—	1	232	2	323	18	7,920
Malacca ...	46	81,041	73	30,006	—	—	27	8,026	5	1,054	151	120,127
Penang ...	1	492	5	910	—	—	3	419	—	—	9	1,821
Singapore ...	12	16,225	49	12,865	—	—	2	1,114	2*	457	65	30,661
Total S.S. ...	87	146,809	162	52,864	—	—	34	9,910	9	1,834	292	211,417

*Including one estate owned by Arabs.

TAPPABLE RUBBER OUT OF TAPPING, MALAYA, 1931.

(Estates of 100 acres and over)

Month	Federated Malay States					Straits Settlements						Unfederated Malay States						
	Perak	Selangor	Negri Sembilan	Pahang	Total F.M.S.	Province Wellesley	Dindings	Malacca	Penang	Singapore	Total S.S.	Johore	Kedah (a)	Kelantan	Trengganu (b)	Perlis	Total U.M.S.	Total Malaya
January ...	25806	36218	28495	10321	100826	9171	1809	17353	798	8993	38124	Statistics not compiled						—
February ...	27496	39958	36965	6429	110848	8498	1873	23508	1277	14156	49312		„	„	„			—
March ...	34892	44285	30480	11186	126843	9780	1548	25021	1280	14027	51656		„	„	„			—
April ...	36068	49395	35408	10557	131428	11299	1845	21084	1140	14475	49843		„	„	„			—
May ...	32485	45592	39582	11227	128886	14382	1677	25790	807	14864	57520		„	„	„			—
June ...	34619	47599	41752	11389	135359	10166	1569	25404	920	14027	52086	74376	13354	Statistics not		Compiled		—
July ...	36158	50005	36937	11273	134373	10636	1713	25512	917	15609	54387	73047	13354	„	„	„		—
August ...	36442	54813	38479	11181	140915	10779	1931	23199	912	14893	51714	72609	13354	„	„	„		—
September ...	37015	53754	38602	11323	140694	10886	1938	22695	897	15319	51735	72775	29743	„	„	„		—
October ...	36770	53324	40824	12172	143090	11069	1896	22764	884	15731	52344	69077	29743	„	„	„		—
November ...	35757	50690	37559	11381	135387	10905	1876	22088	862	15810	51541	68502	29743	7699	nil	464	106408	293336
December ...	35382	49238	35861	11105	131586	11530	1875	21024	862	15982	51273	65535	26881	10899	nil	464	103779	286638

(a) Registered Companies only and are rendered quarterly.

(b) Registered Companies only.

PRODUCTION OF RUBBER, MALAYA, 1931.

Month	Straits Settlements		Federated Malay States.		Unfederated Malay States.		Total Malaya	
	Estates	Small holdings	Estates	Small holdings	Estates	Small holdings	Estates	Small holdings
January ...	2,032	2,000	12,268	10,029	6,492	6,100	20,792	18,129
February ...	1,809	2,000	11,383	9,282	5,587	5,576	18,779	16,858
March ...	1,810	2,000	11,447	10,235	5,656	6,121	18,913	18,356
April ...	1,723	1,738	9,927	5,754	5,389	4,433	17,039	11,925
May ...	1,928	2,420	11,142	7,982	5,834	4,997	18,904	15,399
June ...	1,985	2,626	11,316	8,727	5,713	5,320	19,014	16,673
July ...	2,220	2,128	12,723	8,056	6,428	5,507	21,371	15,691
August ...	2,213	2,584	12,588	7,693	6,140	4,829	20,941	15,106
September ...	2,137	2,416	11,995	9,687	6,108	4,490	20,240	16,593
October ...	2,266	2,168	12,493	8,473	6,432	5,642	21,191	16,283
November ...	2,273	2,414	11,848	10,263	6,984	4,830	21,105	17,507
December ...	2,370	2,448	12,327	9,197	6,552	6,943	21,249	18,588
Total ...	24,766	26,942	141,457	105,378	73,315	64,788	239,538	197,108

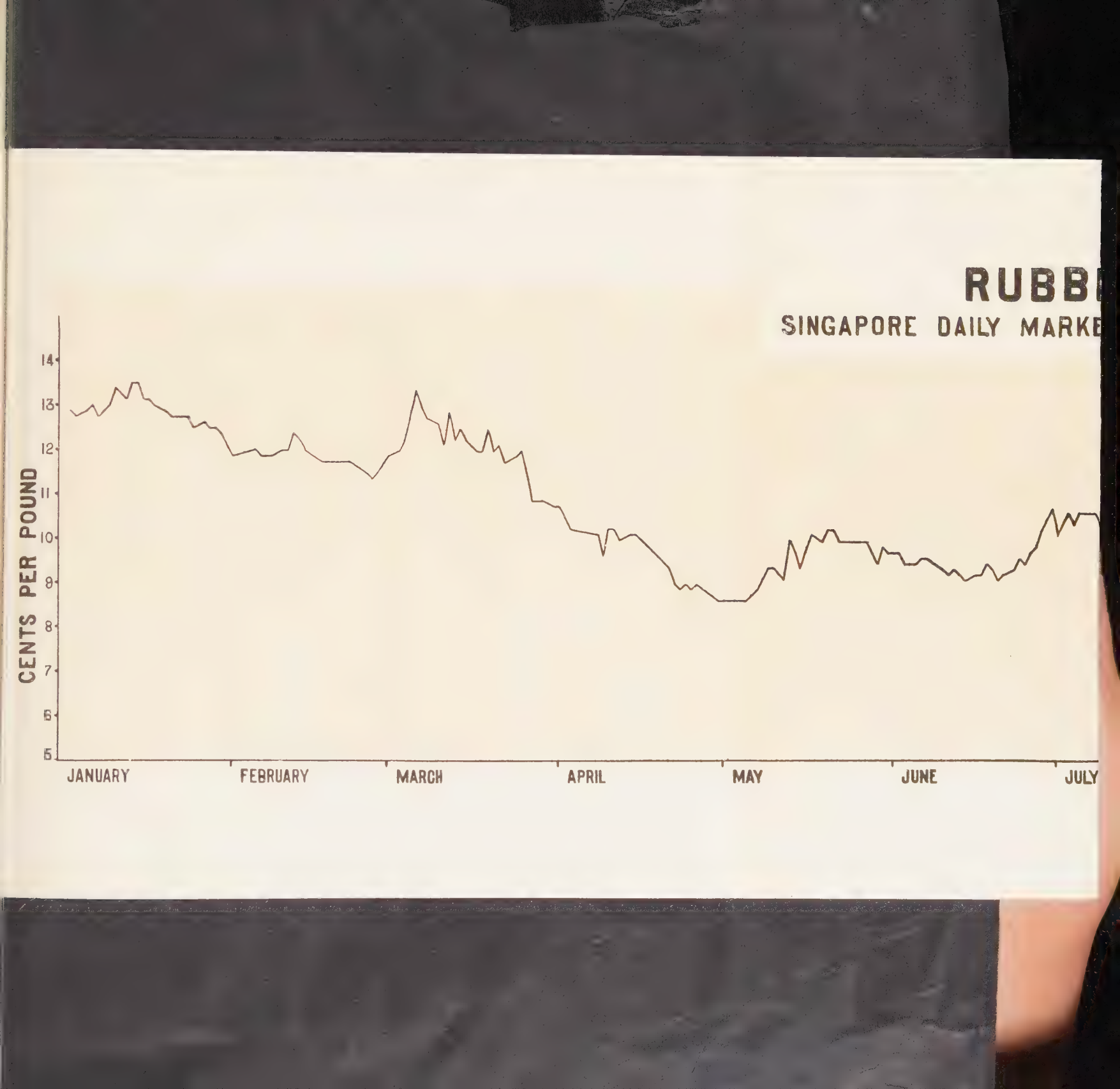
Compiled from monthly records published by the Department of Statistics, S.S. & F.M.S.

PRODUCTION RATE ON RUBBER ESTATES—F.M.S. & S.S.

YEAR 1931.

Month	Federated Malay States			Straits Settlements		
	Estates		Small Holdings	Estates		Small Holdings
	Production on total tappable rubber lbs. per acre per annum	Production on area actually tapped lbs. per acre per annum	Production on probable tappable area* lbs. per acre per annum	Production on total tappable area lbs. per acre per annum	Production on area actually tapped lbs. per acre per annum	Production on probable tappable area* lbs. per acre per annum
January ...	421	483	518	280	351	431
February ...	422	480	512	267	359	433
March ...	393	471	529	251	344	431
April ...	353	426	307	246	330	384
May ...	383	460	412	267	362	522
June ...	401	488	461	283	392	584
July ...	437	530	418	307	418	458
August ...	432	530	397	306	420	557
September ...	428	522	507	315	416	537
October ...	430	527	438	313	432	467
November ...	420	511	547	324	445	537
December ...	318	381	616	328	448	527
Average yield per acre per annum	403	484	472	291	393	489

* Planted area at the end of 1926.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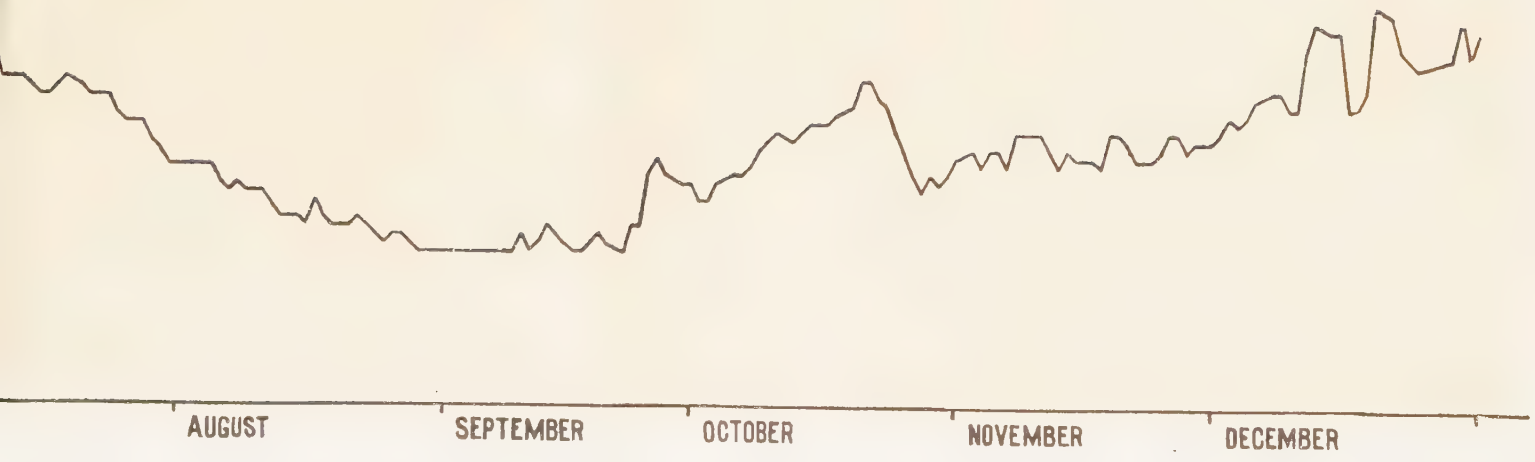

K. P. CO. LTD.

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT END OF FEBRUARY, 1932

AREA	Acreage of Tappable Rubber end 1931	Estates which have entirely ceased tapping		Estates which have partly ceased tapping		Total (3) + (5)	Percentage of (7) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Federated Malay States ...	784,574	33,678	4.3	96,660	12.3	130,338	16.6
Johore ...	313,385	21,309	6.8	46,511	14.8	67,910	21.6
Kedah (*a*) ...	(*b*) 118,236	11,175	9.4	15,706	13.3	26,881	22.7
Kelantan ...	16,785	6,742	40.2	796	4.7	7,538	44.9
Trengganu (*c*) ...	4,300	nil	nil	nil	nil	nil	nil
Perlis ...	624	308	49.4	156	25.0	464	74.4
Straits Settlements ...	190,661	18,520	9.7	34,797	18.3	53,317	28.0
MALAYA ...	1,428,565	91,822	6.4	194,626	13.6	286,448	20.0

Notes:—1. (*a*) Registered companies only and are rendered quarterly, commencing with end June 1931,

(*b*) Estimated in the ratio of acreage of tappable rubber to acreage planted end 1930.

(*c*) Registered companies only.

2. Areas rested due to rotational tapping system end February: acres F.M.S. 44,428, Johore 35,248, Kedah 34,713, Kelantan 1,005, Trengganu 1,394, S.S. 15,284, total 132,072 acres or 9.2 per cent. of tappable area (Col. 2).

SINGAPORE, *April* 11, 1932.

J. I. MILLER, M.C.S.
Ag. Registrar-General of Statistics, S.S. and F.M.S.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MARCH, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
				during the month	during the year 1932	during the month	during the year 1932	during the month		during the year 1932		during the month		during the year 1932				
	Ports	Dealers	Estates of 100 acres and over					Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	19,408	13,063	10,822	35,991	6,154	23,923	Nil	Nil	Nil	Nil	12,627	4,847	39,287	18,834	...	19,432	12,524
Johore	..	2,410	3,462	3,531	11,111	2,988	10,597	Nil	3	Nil	14	969	5,427	2,828	18,755	...	2,437	3,561
Kedah	...	431	2,279	1,969	6,794	697	2,879	Nil	Nil	Nil	Nil	625	2,120	1,910	7,739	...	429	2,202
Perlis	...	29	10	6	19	5	33	Nil	Nil	Nil	Nil	Nil	6	Nil	42	...	33	11
Kelantan ...	...	199	124	158	399	70	1,053	48	Nil	73	Nil	49	314	146	1,345	...	112	124
Trengganu ...	...	55	50	77	284	38	141	Nil	Nil	Nil	Nil	Nil	115	Nil	425		55	50
Total Malay States	...	22,532	18,988	16,563	54,598	9,952	38,626	48	3	73	14	14,270	12,829	44,171	47,140	...	22,498	18,472
STRAITS SETTLEMENTS																		
Malacca ...	...	4,945	1,227	1,263	4,182			Nil		Nil		3,650		11,756		...	4,565	1,335
Province Wellesley	...	86	598	395	1,132	(2)	(2)	Nil		Nil						...	78	704
Dindings ...	...	187	116	85	302	1,482	5,774	Nil	12,834	Nil	47,229	4,667	Nil	17,772	Nil	...	275	89
Penang	1,595	5,609	10	1	11			463		2,071						1,150	4,600	11
Singapore ...	3,594	40,668	224	155	496			5,016		17,749		17,350		50,850		2,365	38,039	220
Total Straits Settlements	5,189	51,495	2,175	1,899	6,078	1,482	5,774	5,479	12,834	19,820	47,229	25,633	Nil	80,378	Nil	3,515	47,557	2,359
TOTAL MALAYA	5,189	74,027	21,163	18,462	60,671	11,434	44,400	5,527	12,837	19,893	47,243	39,903	12,829	124,549	47,140	3,515	70,055	20,831

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province Wel'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	16,614	35,363	4,278	4,706	900	61,861
WET RUBBER	2,818	2,676	322	212	1,537	7,565
TOTAL ...	19,432	38,039	4,600	4,918	2,437	69,426

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1932
Singapore ...	26,057	74,825
Penang ...	8,804	29,591
Port Swettenham.	4,613	16,564
Malacca ...	429	3,569
MALAYA ...	39,903	124,549

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	during the year 1932
Malay States ...	34,076	103,083
Straits Settlements		
MALAYA ...	34,076	103,083

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2 The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] — [2] — [3] + [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber. The Kelantan figures in columns 5 and 19 have not been received and those for February are repeated.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by W. R. Boyd, M. C. S., Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd April, 1932.

Departmental.

FROM THE DISTRICTS.

The Weather.

The weather varied considerably in different parts of the country during the month. In Kedah the short wet season commenced in the middle of the month, while wet weather with frequent thunderstorms, often accompanied by high winds, was experienced in Penang and Province Wellesley, the inland districts of Perak and Selangor and the east coast of Pahang. In western Pahang, Negri Sembilan and Johore the weather was hot with showers or thunderstorms at intervals. On the west coast from Krian southward to Singapore Island conditions were fairly hot and dry, except in Selangor where the second half of the month was wet and stormy.

Remarks on Crops.

Rubber.—Prices for small-holders' rubber ranged in dollars per picul from 4 to 7 for smoked sheet, 3 to 6 for unsmoked sheet, 1 to 4 for scrap and 1 to 3.75 for lump. Exceptionally high prices of $10.25 for smoked and $8.50 for unsmoked sheet were recorded at Sungei Patani in Kedah. In Penang the market was becoming selective, better prices being given for good quality sheet. In Selangor lump rubber was difficult to sell, as it had been found to be heavily adulterated.

The area untapped is increasing steadily owing mainly to the low price, but in parts also to the commencement of work on padi land. Where tapping is continued it is frequently excessive in an attempt to obtain enough rubber to purchase necessities, especially where owners are entirely dependent on their rubber. In Selangor it was noticed that tapping was being done by children or old men and women, while the more able bodied members of the family employ their time in planting other crops or doing other work.

In Penang rubber interplanted with cloves or fruit trees is being cut out by some owners while in one or two localities in Selangor owners have also cut out some of their rubber to plant fruit and vegetables.

Leaf mildew (*Oidium Heveae*) was reported from Perak South, Selangor, Negri Sembilan, Malacca and parts of Johore, but none of the attacks was serious, except in parts of Johore in which State the disease has now been made notifiable by law.

Mouldy Rot disease became more prevalent in Kedah during the wetter weather and its control was increasingly difficult to enforce. Elsewhere it was not more in evidence than usual and in some localities it decreased owing to cessation of tapping.

Padi.—The padi harvest was practically completed everywhere at the end of the month, and yields were on the whole satisfactory, except in areas along the Pahang and Perak rivers damaged by the floods in December, 1931.

In parts of Selangor the inter-season crop was planted, while elsewhere preparation of the land was commenced before the time arranged owing to the desire for additional supplies of padi as early as possible. In Pahang an unexpected flood in March destroyed many nurseries along the Pahang river. These were resown where seed was available, but in the Pekan District a further seed supply of a short duration variety has had to be procured through this Department. Elsewhere in Pahang, in Negri Sembilan and Johore work on the new crop in different stages of advancement was in progress.

It is noteworthy that in Province Wellesley a few enterprising Malays owning well-drained land have planted about half an acre each of fallow padi land with vegetables, while near Lenggong in Perak maize has been planted after the padi crop. Where planting operations are in progress efforts are being made to utilise all available padi land.

In Malacca arrangements were made for the organised distribution of selected padi seed.

Padi prices have fallen slightly, ranging between 6 and 8 cents in the larger padi areas and between 6 and 12 cents elsewhere.

Pineapples.—Canning factories in Singapore were working overtime to cope with the large quantities of fruit received. In Johore also all the factories were working at full output. Prices both for fresh and canned fruit were considerably higher than during the corresponding period of last year. Prices for Good Average Quality canned pineapples varied from $3.58 to $4/- per case and a premium of 60 cents was paid by London buyers for Golden quality.

Tobacco.—While the cultivation of this crop is declining in Penang and Province Wellesley, interest in it is well maintained in many other parts of the country. Prices are, however, falling owing to the inferior quality of much of the cured leaf produced. The wide range of prices from $10/- to $80/- per picul according to locality and quality is an indication of the need for better methods of preparation and of the advisability of studying, before planting is commenced, the kinds of tobacco for which there is a local demand, so that the correct type can be planted and the method of curing be adopted to meet local requirements.

Tea.—There has been a very considerable improvement in the yields as well as in the growth of the tea bushes on the Chinese small holdings at Sungei Balak in Selangor as a result of following the advice given by this Department. The Chinese headman claims that his yield has doubled and that he is now making a good profit although the price has fallen to 30—35 cents per kati for first quality tea.

Fruit.—In Johore the mango crop in Muar District was harvested and exported to Singapore. Early durians appeared on the markets in Selangor and Negri Sembilan together with small supplies of rambutans, mangosteens and

langsats in the latter State. In most localities the fruit crop has just set and promises well, but in Penang rain caused a heavy loss of very young fruits.

Malays everywhere are paying more attention to their fruit orchards and are planting bananas and pineapples on spare pieces of land.

Rat Control in Padi Fields.

During organised rat hunts for the purpose of digging nests of young rats out of the bunds of padi fields at Glugor in Penang island 6,000 rats were destroyed in three and a half days. In Province Wellesley this method of destruction continues to be neglected by padi planters even in their own interests. The distribution of poisoned baits has, however, been continued and over 1,000 dead rats have been found. In Krian trapping and poisoning in known breeding grounds and harbourages have been maintanied with good results. In Malacca 96,928 tails were collected, many of the rats being dug out of nests in the padi fields.

Agricultural Stations and Padi Test Plots.

KEDAH.—*Gajah Mati Agricultural Station.*—The drainage system and necessary paths were completed as well as two nursery sheds. The growth of the cover crops improved after the rains. Preparations were made for planting tuba, soya bean and cotton.

PENANG AND PROVINCE WELLESLEY.—*Glugor Padi Test Station.*—A full report on the working of the Station during the 1931—32 season was completed and forwarded to headquarters for statistical examination. Nurseries for the inter-season crop made good growth in spite of heavy rains and floods. The plots for this crop were cleared in readiness for planting.

Bukit Merah Padi Test Station.—Ploughing was commenced early in the month and though hampered by heavy rains and floods was nearly completed at its close. Preparations were made for a small trial to demonstrate the possibilities of growing short-season vegetables and food crops during the period of 3 or 4 months when the land is normally allowed to lie fallow.

PERAK.—*Kuala Kangsar Agricultural Station.*—Crops planted were six stumps of each of four selected clones of budded rubber and fourteen varieties of yams. A good crop of an Australian strain of maize was reaped and a Rangoon variety of tobacco was harvested and yielded some very good leaves. Two varieties of tobacco, Chinese and Rangoon, were in process of curing, a procedure which was rendered difficult by wet weather. Giant snails, which found shelter in cover crop of *Calopogonium mucunoides,* proved troublesome and damaged young egg-plants. These pests were collected nightly.

Bruas Padi Test Plot.—The yields of the different plots have not yet been fully calculated, but the average yield is expected to be about 300 gantangs per acre as compared with yields of 50 to 100 gantangs per acre obtained from this land in past years by local cultivators.

Selangor.—*Cheras Agricultural Station.*—Crops planted were two varieties of sireh, soya bean, rambutans, oranges, two selected pomelo marcots from China, gambier, cloves and a few stumps of four selected clones of budded rubber. Oil palms for shade purposes were planted on either side of the access road and the yellow-flowered *Peltophorum ferrugineum* along the road frontage for ornamental purposes. The Chinese market gardener planted up with vegetables the area allotted to him. The work of levelling off the sides of the fish pond and planting them with carpet grass was completed..

Kajang Padi Test Plot.—The clearing of the land was completed and the layout of plots improved. Transplanting from the nurseries was commenced at the end of the month.

Kuang Padi Test Plot.—Transplanting was commenced with Nachin 27 early in the month and was in progress with other strains at its close. Tuba solution successfully checked the attack of stem borer on the nursery seedlings of N. 27, but a few days after transplanting a number of Schoenobius moths and egg masses were found on the young plants in the fields, the moths having apparently emerged from "volunteer" padi. Egg masses were collected daily in the hope of preventing permanent damage.

Negri Sembilan.—*Rembau Agricultural Station.*—Seeds of cloves and nutmegs obtained from Penang were sown in nursery beds. To meet the demand for Sweet Corn seed an extra half acre was sown. A few budded rubber stumps of four selected clones were planted. Paths were planted with carpet grass and the drains received attention.

Pahang.—*Kuala Lipis Agricultural Station.*—The flood at the end of March destroyed the tobacco, while ten arecanut palms died owing to the effects of the previous flood.

Temerloh Agricultural Station.—Drainage received attention. The covers and green manures made good growth. Liberian coffee seed was sown in the nursery.

Kuantan Agricultural Station.—Local tapioca, yams, sweet potatoes, maize and cowpeas were planted.

Pekan Agricultural Station.—Plots were replanted with tapioca, yams, maize and cowpeas. Several varieties of bananas were also planted. There was a good crop of oranges and limes.

Padi Test Stations.—Preparation of the Dong Station for the coming season's crop was commenced. At the Pekan Station two strains of padi were sown and the new land was cleaned.

Malacca.—*Sungei Udang Agricultural Station.*—Crops planted included sweet potatoes, tapioca, sugar cane, ginger, arrowroot, sorghum, thirty varieties of vegetables, and six cinnamon seedlings. Pepper cuttings were planted out. Considerable progress was made with the levelling and bunding of the padi area.

Singapore.—*Pineapple Experiment Station.*—The growth and appearance of the pineapples on the manurial plots has improved recently. The planting of green manurial crops on the plots reserved for green dressing and rotation

experiments was completed. The growth of the Hickory Prior variety of Virginian tobacco has been disappointing and the indications are that this variety is not so well suited to local conditions as the Joyner variety. It is satisfactory to note that the work at this station on tobacco and fruit trees, as well as on pineapples, is beginning to attract the attention of local agriculturists, more especially Chinese, whether owners of larger or of smaller properties.

School Gardens.

All school gardens have now been recultivated and replanted, but in some parts of the country the recently prepared beds have been severely washed and the young growing vegetables killed by heavy rains, necessitating reforming the beds and replanting. A number of gardens, however, showed good progress.

In Johore the new school gardens have been supplied with tools and lime where needed. Good progress has been made with the layout of the gardens and preparation of the beds which at most schools are nearly ready for planting.

EIGHTH MALAYAN EXHIBITION.

The Malayan Agri-Horticultural Association has decided to hold its annual Exhibition at Kuala Lumpur during the August Bank Holidays.

It is expected that the general scheme of the Exhibition will follow the lines of the Exhibition held last year. The various sections make provision for exhibits of all kinds of agricultural products of Malaya. Special attention will be given to foodstuffs and to the economic aspects of agricultural enterprise.

The fact that Malaya is experiencing a very grave economic depression should render this event of more than ordinary interest, for the attention of producers must be directed to the consideration of means of reducing costs of production and improving quality. The Exhibition will serve a very useful purpose if it assists in any way the achievement of these objects.

The organisers confidently look to all those engaged in agriculture for their support in sending exhibits. Full particulars will be published in due course, but those who wish for early information are invited to address their enquiries to the Secretary, Malayan Agri-Horticultural Association, 12 Barrack Road, Kuala Lumpur.

DEPARTMENTAL NOTES.

Tours of the Director of Agriculture.

The Director of Agriculture visited Fraser's Hill on February 27th and 28th and again on April 2nd and 3rd for the purpose of inspecting the work at the Dairy Farm. He made a tour to Negri Sembilan and Malacca between March 18th and 22nd, inspecting the principal departmental undertakings, visiting a number of estates and conferring with the Resident and Resident Councillor. He visited Cameron Highlands on April 8th to 11th, inspecting the work of the Agricultural Experiment Station and also visiting certain settlers in this region.

Investigations in the Chemical Division.

The monthly reports of the Chemical Division record a wide range of activities and shew also the extensive use which various agricultural industries in Malaya make of the facilities for investigation and advice offered by this branch of the Department of Agriculture.

During the month of March, 25 samples submitted by unofficials were examined. Twenty of these samples were sent from oil palm estates for analysis and report, two were concerned with jelutong and three with manures. The reports connected with samples sent from oil palm estates enable the producers to effect improvements in the technique of the production of palm oil and kernels, resulting in economy of production and improvement in quality.

Advisory work necessitated 17 visits, 14 of which were to the Government Experimental Plantation, Serdang. Furthermore, advisory work, not necessitating analyses or visits, numbered 6 and dealt with a wide range of subjects.

The research work of the Division is concerned with a number of crops and in one month necessitated 54 analyses.

The Chemical Division has a series of experimental work on the production of palm oil and kernels which is carried out in the experimental factory at Serdang. The manufacture of palm kernels was commenced during March. A small Culley net-cracker is being used and the kernels are separated by means of a clay bath.

A series of experiments have been carried out to determine the amount of palm oil that could be recovered by centrifuging a second time, after breaking up the residue and spinning for a further period of 10 minutes and injecting more steam. The results shewed that only a very small amount of oil was recovered, the oil content of the pericarp residue, calculated on a moisture-free basis, being reduced on the average from 24 to 23 per cent.

Other experimental work may be summarised as follows—

Coconuts.—An investigation regarding the composition of material from the point of view of plant nutrients removed from palms in the course of estate practice has been completed. The results are being summarised for publication.

Tuba Root.—Investigations regarding the rotonone content of tuba root from different local sources has been continued.

Padi.—An investigation has been commenced on the variation in the moisture content of padi as purchased at the Government Rice Mill, Bagan Serai.

An investigation on the chemical control of weed growth in padi irrigation water is in progress.

Fodders.—Investigations are continued on the natural variations in composition of fodder grass growing on the same plot.

Forest products.—An investigation on the relationship existing between the durability of certain timbers and the amount of alkali soluble material has been commenced.

Dairy, Poultry and Gardens at Fraser's Hill.

Mr. H. Ritchings, Horticultural Assistant, was in charge of the work at this station until he proceeded on leave on 3rd March, when Mr. C. M. Maggs was detailed to take over the work. Unfortunately the latter officer has been admitted to hospital, in consequence of which Mr. F. S. Banfield, Horticultural Assistant, was transferred to Fraser's Hill on 7th March to take his place.

The number of cattle at the Dairy Farm has been reduced by the sale of several old cows unfit for the dairy herd. A number of pure-bred Friesian bull calves have also been sold for breeding purposes.

In spite of such reductions the quantity of milk has increased and is ample to meet the present demand at Fraser's Hill. Arrangements have now been completed for the transport of fresh milk to Kuala Kubu.

Fat tests are regularly made of the milk. The average fat content of the milk is over 4 per cent., which is extremely satisfactory.

Egg production has been maintained and there has been no difficulty in the sale of produce at remunerative prices.

The very rainy weather has interfered somewhat with the quality of vegetables, but the supply for sale at Fraser's Hill has been fully maintained.

Leave.

Mr. H. T. Pagden, Assistant Entomologist, has been granted 8 months and 7 days leave on full pay, with effect from 12th February 1932.

Statistical.

MARKET PRICES.

April, 1932.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 5.4 cents per lb. in Singapore, 1.46 cents (Gold) New York and 2.97d. per lb. London, as compared with 6.39 cents Singapore, 3.3 cents New York and 2.16d. London in March. The highest Singapore price in April was 5 7/16 cents and the lowest 5 1/16 cents per lb.

Palm Oil.—Cabled weekly quotations per ton during April, c.i.f. Liverpool on a basis of 18 per cent. f.f.a. were as follows:—1st, £19; 7th, £17; 14th, £16; 12st, £16; 28th, £16.10.0. Prices declined on the firming up of sterling. The market has been idle, but closed steady.

Regular quotations for palm kernels have not been received, the last price noted being £10.15.0 per ton on 7th April.

Copra.—Prices have remained steady during the month. Sundried averaged $5.67 per picul as compared with $6.17 in March, while the average price for Mixed was $5.06 per picul as compared with $5.67 in the previous month.

Copra cake was quoted at $2.00 per picul throughout the month.

Gambier.—Prices have further declined during April, the average Singapore price for Cube No. 1 being $17.50 per picul and for Block $8.37 as compared with $18.90 and $11.80 respectively in March.

Rice.—The following are the average wholesale prices of rice per picul in Singapore in March:—Siam No. 2 Ordinary, $4.26; Rangoon No. 1, $4.12; Saigon No. 1, $4.24 as compared with $4.62, $4.17, $4.37 respectively in February.

Retail market prices in cents per gantang of No. 2 Siam rice in March were:—Singapore 32, Penang 38, Malacca 30. Corresponding prices in February were 32, 38 and 26.

Arecanuts.—Prices show a tendency still further to decline. Average Singapore prices in April were:—Palambangs $3.24, Bila $3.32 per picul as compared with $3.62 and $3.59 respectively in March. For other grades the average prices per picul were as follows:—Split $4.06 to $5.58, Red $6.55 to $7.61, Sliced $10.70 to $12.85, Kelantan Split $5.06 to $5.49, the price within each range depending upon quality.

Coffee.—The Singapore market has been quiet and prices show a slight decline during the month. Average price of Sourabaya coffee was from $19.95 to $21.25 per picul, the price within these limits depending upon quality. The average price of Palambang coffee was $15.65 per picul as compared with $16.83 in March.

Pineapples.—The market has been somewhat lifeless. Increased Canadian duties are stated to have brought business with that country to a standstill, resulting in larger supplies being available for shipment to the United Kingdom.

Buyers are generally well below packers' prices. Average prices in April were 1½ lb. cubes $3.47½ per case, 1½ lb. sliced flat $3.30 per case, 1½ lb. sliced tall $3.52½ per case as compared with $3.63, $3.41 and $3.73 per case in March.

Tapioca.—Prices of all grades shew a further fall over those quoted in March. Singapore average prices per picul in April were :—Flake fair $2.81, Pearl, seed $3.85, Pearl, medium $4.21 as compared with $3.12, $4.48, $4.70 in March.

Sago.—Prices showed a slight upward tendency towards the end of the month. Average prices for April were :—Pearl, small, fair $4.17½ per picul as compared with $4.45 for the previous month; Flour, Sarawak fair $2.17½ as compared with $2.38 in March.

Nutmegs and Mace.—Prices have been more or less nominal throughout the month with but little business. Average prices per picul for mace were as follows :—Siouw $68.75, Amboina $45 as compared with $59.40 and $44 in March.

Singapore average prices for nutmegs in April were, 110 per lb. $25.37½ per picul, 80 per lb. $28.87½ as compared with $26.90 and 30.70 per picul in March.

Pepper.—Demand has been small and prices have shown little variation. The following are the average Singapore prices per picul for April :—Singapore black $20.25, Singapore white $24.25, Muntok white $24.75. Corresponding prices in March were $22.30, $27.90 and $28.35.

Cloves.—Nominal prices have been quoted throughout the month in Singapore at $47 per picul for Zanzibar, and $50 for Amboina.

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133⅓ lbs.

The dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.*

March, 1932.

Malaya.—Gross foreign imports of rice during March amounted to 47,189 tons as compared with 60,481 tons in March 1931, of which 49.2 per cent. were consigned to Singapore, 25.2 per cent. to Penang, 5.3 per cent. to Malacca, 17.8 per cent. to the F.M.S. and 2.5 per cent. to the Unfederated Malay States.

Of these imports 44.3 per cent. were from Siam, 53.2 from Burma, 1.5 per cent. from French Indo-China and 1 per cent. from other countries.

The total foreign exports of rice in March were 13,668 tons as compared with 13,474 tons in March 1931. Of these exports, 81 per cent. went to Netherlands India.

India.—Total foreign exports of milled rice (*Indian Trade Journal* 31.3.32) during January 1932 were 168,000 tons as compared with 151,000 tons in December 1931.

Total exports of rice and rice products from Burma for the period January 1 to February 27, 1932, amounted to 600,549 tons as compared with 496,893 tons for the corresponding period of 1931, or an increase of 20.9 per cent.

Japan.—It is reported that the Government of Japan had decided to import 140,250 tons of foreign rice through nine large rice merchants and that this year's (1931—32) rice deficit is nearly 700,000 tons.

Siam.—According to the Third and Final Forecast of the 1931 Rice Crop (Principal Trade Commissioner, Ministry of Commerce and Communications, Bangkok) the latest returns giving the conditions of the crop at the end of January 1932 show an increased yield and the exportable surplus of the Seven Inner Circles is estimated at 1,040,000 tons (rice) as compared with 1,000,000 tons (rice) mentioned in the Second Forecast. The Northern and North-Eastern Circles, which were estimated to be able to provide only for their own needs, is now estimated to have a surplus of 60,000 tons (rice) for export. The exportable surplus for the whole Kingdom is therefore estimated at 1,100,000 tons of rice.

Exports of rice from Bangkok during February 1932 amounted to 122,091 tons as compared with 97,612 tons in February 1931, an increase of 15.1 per cent.

Exports of rice from Bangkok during the period December 1931 to February 1932 amounted to 347,620 tons, an increase of 62,337 tons or 22 per cent. as compared with the same period of 1930—31.

The average value of the exports during February 1932 was $(S)48.64 per ton as compared with $(S)67.98 in February 1931, a decrease of 28.4 per cent. (104 ticals = $100 (Straits)).

* The following is abridged from the Rice Summary for March 1932, compiled by the Department of Statistics, S.S. and F.M.S.

Netherlands India.—The *Korte Berichten* states that at the end of February 1932, the area harvested amounted to 451,500 acres, an increase of 66,500 acres or 17.3 per cent. as compared with the same period of 1931, the area damaged to 17,162 acres an increase of 5,850 acres or 51.7 per cent. as compared with 1931, and additional plantings awaiting harvest to 6,956,250 acres an increase of 49,000 acres or .7 per cent. as compared with 1931, a total of 7,424,812 acres as compared with 7,303,560 acres for the same period of 1931, an increase of 1.7 per cent.

Imports of rice into Java and Madura during January and February, 1932 totalled 48,945 tons as compared with 61,731 tons for the same period of 1931 or a fall of 20.7 per cent.

French Indo-China.—Entries of padi at the port of Cholon from 1.1.32 to 31.3.32 amounted to 331,038 (metric) tons, an increase of 72,087 tons or 27.7 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period 1.1.32 to 31.3.32 amounted to 318,813 (metric) tons an increase of 96,110 tons or 43.1 per cent. as compared with 1931.

The following is an extract from the International Crop Report, Rome, for February, 1932 :—" The rains of September were on the whole very beneficial, despite some destructive flooding; they allowed late transplantings to be carried out in some districts. Additional information indicates an extention of cultivated area in Tonkin; in Cambodia it does not seem that there has been any considerable reduction in area. The very heavy decrease in Annam and Cochin-China will, however, result in a reduction for Indo-China as a whole of about 1 million acres on that of last year so that the cultivated area has fallen back to the average level of the five years ending 1929—30.

The few partial data available and the general information regarding the crops harvested or the condition of those still standing makes it possible to say that the 1931—32 crop will be little below that of the previous season, despite the decrease in area; owing to the unfavourable conditions in Annam and despite the satisfactory results obtained in Tonkin, the unit-yield for Indo-China as a whole seems to be a little below the average but above that of last season and at least equal to that of 1929—30.

The few data available concerning stocks indicate that they are exceptionally high; according to official information there remained in Cochin-China on 15 September 1931 that is, six months after the harvest, though the commercial year is generally at an end for that Colony, about 440 million pounds of rough rice available for export, of which almost all must be spread over the 1932—33 season. In Tonkin and in Annam movement of the crop is difficult owing to the very strict limitation of exports and stocks are equally abundant and maintain the price at a level insufficient to cover cost of production."

The padi market (official report) in March 1932 was quiet with a tendency to weaken, owing to the amount of rice sold being less than the amount of padi received from the interior; the stocks held at Cholon were considerable.

The prices in the rice market rose in sympathy with the Rangoon market in the expectation of big orders to be placed by Japan.

As Japan did nothing and the other markets evinced no interest in Saigon, prices dropped rapidly. France bought moderate quantities and Hong Kong remained the chief buyer. The market as a whole was quiet with a tendency to fall but any important enquiries would probably cause a quick upward reaction.

The Brokens market was calm but steady. India made considerable purchases but finally only France was in the market for small packets.

Europe and America.—Quantities of rice shipped from the East were :—

(*a*) To Europe, January 1 to March 23, 1932, 186,090 tons as compared with 111,308 tons for the same period of 1931, or an increase of 67.2 per cent.

(*b*) To the Levant, period January 1 to February 22, 1932, 9,711 tons, an increase of 6,509 tons or 203.3 per cent. as compared with the same period of 1931.

(*c*) To the West Indies and America, period January 1 to February 18, 1932, 27,323 tons, an increase of 4,914 tons or 21.9 per cent.

MALAYAN AGRICULTURAL EXPORTS, FEBRUARY, 1932.

PRODUCT.	NET EXPORTS IN TONS.				
	Year 1931	Jan. & Feb. 1931	Jan. & Feb. 1932	Feb. 1931	Feb. 1932
Coconuts, Fresh ...	10,468	1,207	13,217	667	6,658†
Copra ...	100,809	14,207	13,053	6,628	7,559
Coconut oil ...	9,909	1,441	1,711	627	752
Palm oil ...	4,574	508	821	213	429
Palm kernels ...	726	57	170	43	125
Pineapples, canned ...	59,457	10,038	11,936	4,557	6,313
Tapioca ...	28,257	4,216	3,905	1,869	2,024
Gambier, all kinds ...	2,563	383	503	198	255
Arecanuts ...	19,266	3,873	4,400	2,019	1,367
Sago ...	5,133	1,079*	2,901	448*	1,712
Tuba roots ..	74	10	7	5	12

† '000 in number.
* Net imports.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS.

First Quarter, 1932.

(As declared by Estates)

YEAR AND MONTH	PALM OIL		PALM KERNELS	
	F.M.S.	JOHORE	F.M.S.	JOHORE
	Tons	Tons	Tons	Tons
1932 January ...	359.4	55.7	63.9	7.7
„ February ...	433.8	47.1	73.2	7.0
„ March ...	651.2	121.9	103.5	15.2
Total for First Quarter 1932 ...	1,444.4	224.7	240.6	29.9

The corresponding figures for the first quarter 1931 were:—

F. M. S. ... Palm Oil 840.5 tons; Palm Kernels 141.3 tons.

Johore ... Palm Oil 158.3 tons; Palm Kernels 27.4 tons.

METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1932.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more	Precipitation, .05 in or more	Thunder-storm	Fog morning obs	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	91.0	71.5	81.3	95	68	74	73	84.0	84.5	16.23	412.3	3.80	18	17	7	6		184.30	5.95	49
Bukit Jeram, Selangor ...	88.5	72.5	80.5	92	70	75	75	85.2	86.5	8.06	204.7	1.84	18	12		1		222.65	7.18	59
Sitiawan, Perak ...	89.2	72.7	80.9	92	69	83	75	84.1	84.4	8.45	214.6	0.94	23	21	8	2		199.45	6.43	54
Kroh, Perak ...	88.6	68.7	78.6	92	62	83	72	81.8	81.9	5.99	152.2	1.30	13	12	2	1		234.50	7.56	63
Temerloh, Pahang ...	87.4	71.9	79.7	93	67	73	76	83.8	84.5	15.70	398.8	5.25	17	14	2	6		178.20	5.75	47
Kuala Lipis, Pahang ...	88.0	71.2	79.6	93	67	77	74	82.6	83.3	10.25	260.3	3.39	17	15	3	14		177.15	5.71	47
Kuala Pahang, Pahang ...	85.5	75.3	80.4	87	69	83	79	83.8	84.0	10.83	275.1	4.10	20	19		1		227.15	7.33	
Mount Faber, Singapore ...	87.1	73.0	80.1	92	71	77	75	80.9	82.1	7.18	182.4	2.16	12	10	3	3		191.85	6.19	51
Butterworth, Province Wellesley ...	88.5	73.3	80.9	91	70	83	75	85.0	84.9	8.12	206.3	1.66	20	15	3		1	248.40	8.01	67
Bukit China, Malacca ...	87.6	73.2	80.4	92	71	77	76	83.1	83.9	4.97	126.3	1.60	15	13	2			211.75	6.83	56
Kluang, Johore ...	88.2	71.5	79.9	94	68	76	74	81.6	82.1	9.38	238.3	1.86	19	14	2	7	1	173.25	5.59	46
Bukit Lalang, Mersing, Johore	83.7	73.4	78.5	85	69	79	77	80.5	79.9	12.27	311.7	3.46	13	12	2			221.45	7.14	59
Alor Star, Kedah ...	93.3	71.5	82.4	97	67	90	74	85.5	85.3	3.08	78.2	1.63	7	6	5	1		252.15	8.13	66
Kota Bahru, Kelantan ...	86.6	71.9	79.3	89	64	85	78	81.7	82.6	2.77	70.4	1.07	12	9		3		246.70	7.96	66
Kuala Trengganu, Trengganu	86.1	72.5	79.3	88	66	84	77	82.3	82.8	2.56	65.0	0.62	18	12		1		240.95	7.77	64
HILL STATIONS.																				
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	71.4	58.4	64.9	76	55	65	60			9.37	238.0	2.23	20	17		3		174.00	5.61	46
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	71.7	56.4	64.1	75	44	67	63	68.3	68.3	9.61	244.1	1.66	20	18	1	9		155.55	5.02	41
Fraser's Hill, Pahang 4268 ft.	71.5	61.6	66.5	76	59	64	64	71.1	71.1	12.69	322.3	2.25	20	18	1	26		150.00	4.84	40

Compiled from Returns supplied by the Meteorological Branch, Malaya.